Draft Environmental Assessment for North Fork Blackfoot River Westslope Cutthroat Trout Conservation Project

Reclamation of the North Fork Blackfoot River upstream of North Fork Falls for Westslope Cutthroat Trout

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EXECUTIVE SUMMARY

This environmental assessment (EA) evaluates a proposed project with the primary purpose of establishing a population of westslope cutthroat trout in the North Fork Blackfoot River watershed upstream of a barrier waterfall in the Scapegoat Wilderness. Secondarily, the project would eliminate a source of nonnative genes that threaten native westslope cutthroat trout in the North Fork Blackfoot River watershed downstream of the barrier falls. Both goals would bring considerable conservation benefit to native trout.

Westslope cutthroat trout (Figure 1) are native to Montana, adjacent states, and parts of Canada. This species has experienced substantial declines in distribution and abundance throughout its historical range. Historically, westslope cutthroat trout occupied an estimated 28,668 miles of stream in Montana (FWP 2020). Currently, conservation populations, those with less than 10% hybridization, remain in 16% of the historical habitat in Montana, and nonhybridized westslope cutthroat trout are present in 11% of their historically occupied habitat (FWP 2020). The loss of westslope cutthroat trout across its historical range has resulted in its designation as a species of concern, a status that requires protection of the species and implementation of projects to secure it in its native range.

Figure 1. Westslope cutthroat trout.

The project area (Figure 2) harbors a heavily hybridized population of rainbow trout × Yellowstone cutthroat trout × westslope cutthroat trout, with rainbow trout genes being the dominant proportion of genes in the project area. Genetic contribution of westslope cutthroat trout ranges from 0% to 17% throughout the project area. Hybridization with nonnative rainbow trout and Yellowstone cutthroat trout is among the most common causes of decline of westslope cutthroat trout, and the hybrids in the project area are a direct threat to a core population of westslope cutthroat trout in the watershed downstream. Greatly reducing the proportion of nonnative genes in the project area by removing as many fish as possible within a season and stocking large numbers of nonhybridized westslope cutthroat trout in the project area for the next 5 years would protect westslope cutthroat trout within the North Fork Blackfoot River watershed and the larger Blackfoot River watershed.

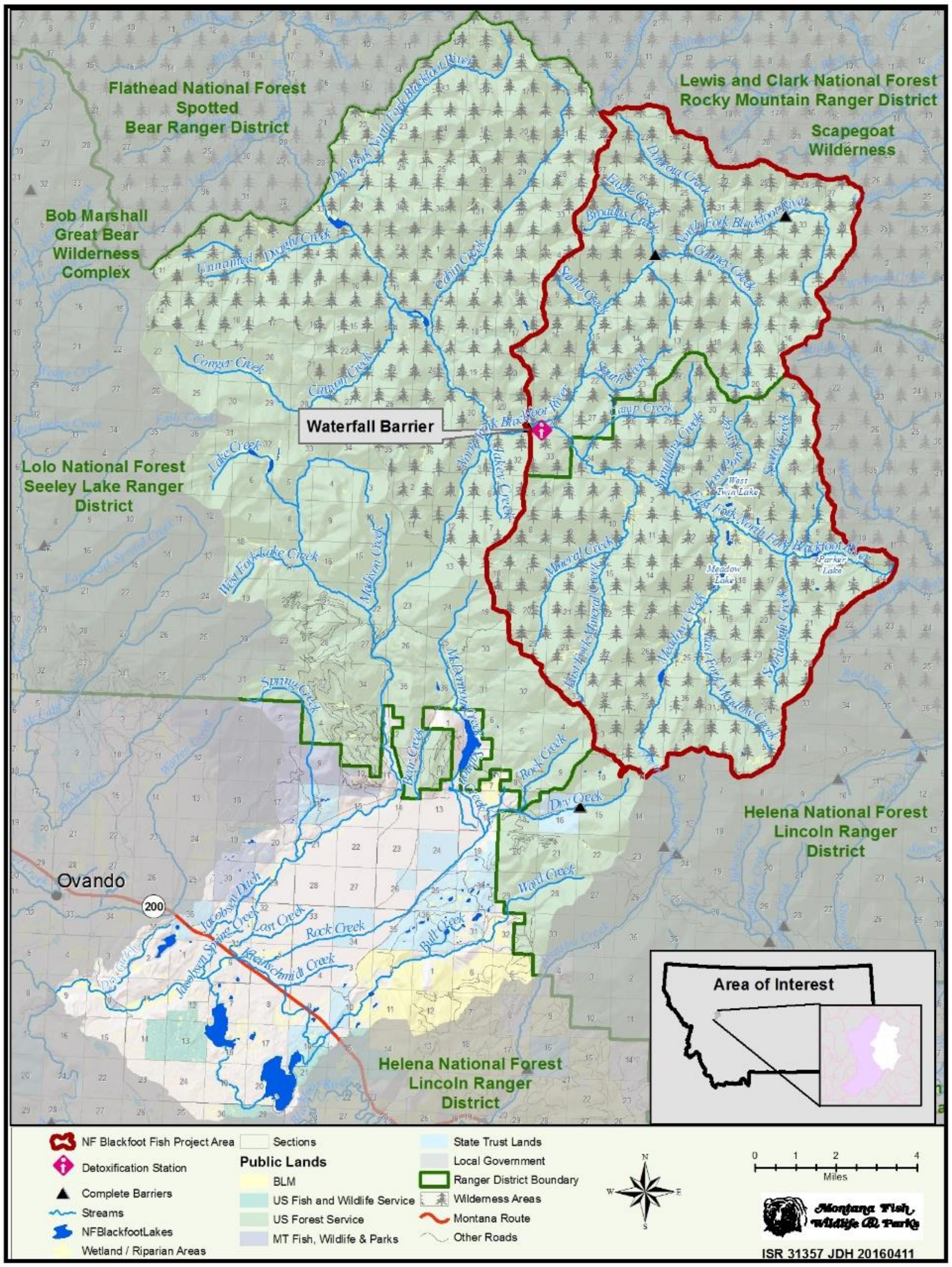

Figure 2. The North Fork Blackfoot River watershed and proposed project area.

The proposed project area is within an area likely to remain cold into the future, which would offset loss of suitable habitat that is occurring with climate change. Furthermore, the hybrid trout are present at lower densities compared to pure westslope cutthroat trout populations in similar environments in adjacent backcountry drainages (Pierce et al. 2018), suggesting that the hybrids are poorly adapted to the project area. The great connectivity in the watershed would allow westslope cutthroat trout to move throughout the watershed, which would promote gene flow and allow fish to recolonize streams following localized catastrophic disturbance. The proposed action would bring considerable conservation benefit and would be consistent with state and federal laws, and conservation planning.

A formulation of rotenone, likely CFT Legumine or Prenfish, would be applied upstream of the North Fork Falls in a single season to remove as many of the hybridized fish as possible. Rotenone is highly toxic to fish, some invertebrates, and gilled amphibians. Aquatic invertebrates and amphibians recover quickly following rotenone treatment. Rotenone would not harm terrestrial wildlife or humans under the proposed protocols.

Full eradication is often the goal of piscicide projects; however, the size and complexity of the watershed would require tremendous effort over multiple years to remove all fish. The goal of this project would be to minimize the proportion of nonnative genes to less than 10%. The strategy would be a combination of a single season of piscicide treatment followed by multiple massive stocking events of nonhybridized westslope cutthroat trout throughout the watershed. Piscicide would kill most fish in the watershed, but a complete kill would not likely occur through the proposed, feasible level of treatment. Repeated and extensive stocking of westslope cutthroat trout would decrease the proportion of nonnative genes that remain in the watershed and greatly decrease risks to westslope cutthroat trout downstream of the project area. Monitoring genetic status would guide stocking efforts over time to achieve the proposed goal of less than 10% nonnative genes in the project area.

This collaborative effort includes Montana Fish, Wildlife & Parks (FWP), the U.S. Forest Service (USFS), including the Lolo and Helena national forests, the U. S. Fish and Wildlife Service (USFWS) and the Montana Department of Justice. Non-governmental partners are the Big Blackfoot Chapter of Trout Unlimited, Montana Trout Unlimited, and local outfitters.

Under the Montana Environmental Policy Act (MEPA) and the National Environmental Policy Act (NEPA), state and federal agencies are required to consider the environmental, social, cultural, and economic effects of proposed actions. This EA meets the FWP's requirement under MEPA to evaluate the potential effects of the project. The USFS will address NEPA requirements separately but concurrently.

This document is an EA of the potential consequences of 2 alternatives to manage fish in the North Fork Blackfoot River. The 2 alternatives considered are:

1. Establish a secure conservation population of nonhybridized to slightly hybridized (<10 % hybridization) westslope cutthroat trout in the North Fork Blackfoot River, upstream of the barrier falls. The existing fishery of hybrids would be removed from streams and lakes using a formulation of rotenone. Nonhybridized westslope cutthroat trout would be stocked in the watershed at levels that would reduce the proportion of remaining nonnative genes in the population.
2. No action.

Alternative 1 is the proposed action. It would have short-term, minor effects on wildlife, recreation, and vegetation. Most fish and some aquatic invertebrates would die; however, not all species or life history stages of invertebrate are vulnerable, and those invertebrates would quickly recolonize treated waters. Gilled amphibians would be vulnerable to rotenone; however, they are resilient to temporary disturbances associated with large scale stream piscicide projects. Rotenone would not pose a health risk to humans or wildlife.

MEPA requires public involvement and opportunity for the public to comment on projects undertaken by the act's respective state agencies. The public comment period for this project proposal will be from July 9 through August 7, 2020. There will also be a public meeting on July 22. Please see public comment and meetings details in sections 6.1 (Public Involvement) and 6.2 (Public Comment Period) of this draft EA.

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LIST OF ABBREVIATIONS

DEQ	Montana Department of Environmental Quality
EA	Environmental Assessment
eDNA	Environmental DNA
EPA	U.S. Environmental Protection Agency
EPT	Ephemeroptera, Plecoptera, Trichoptera (mayflies, stoneflies, & caddisflies)
FWP	Montana Fish, Wildlife & Parks
$KMnO_4$	potassium permanganate
MCA	Montana Code Annotated
MCTSC	Montana Cutthroat Trout Steering Committee
MEPA	Montana Environmental Policy Act
mg/L	Milligrams per liter
MNHP	Montana Natural Heritage Program
MOU	Memorandum of Understanding
MRDG	Minimum Requirements Decision Guide
NEPA	National Environmental Policy Act
ppb	Parts per billion
ppm	Parts per million
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service

1 PROPOSED ACTION AND BACKGROUND

1.1 *Need for Proposed Action*

The westslope cutthroat trout (*Oncorhynchus clarkii lewisi*) is a Montana native and has experienced drastic reductions in distribution and abundance across its historical range. Westslope cutthroat trout have substantial ecological, historical, and economic value. They are part of Montana's natural heritage and are an integral component of a coevolved assemblage of fish, invertebrates, and amphibians that occupied many of Montana's streams and lakes in the western half of the state before widescale introductions of rainbow trout, brown trout, and brook trout began in the late 1800s. Nonnative trout are one of the most common reasons westslope cutthroat trout have been extirpated across much of its historical range. Climate change is another threat that is shrinking the suitable habitat for this cold-water species.

The fish in the North Fork Blackfoot River upstream of the barrier waterfall, known locally as North Fork Falls (Figure 3), is a heavily hybridized population of *Oncorhynchus.* Rainbow trout genes are most prevalent in this population, with Yellowstone cutthroat trout genes being common, and westslope cutthroat trout comprising the smallest genetic contribution. Although a single fish in Cooney Creek had genetic markers only characteristic of westslope cutthroat trout, the sample could not be replicated, and it provided inconclusive evidence regarding the presence of pure westslope cutthroat trout in the project area (Pierce et al. 2018). All other genetic sampling throughout the drainage demonstrated that tributary and mainstem river sections contained trout ranging from 0% to 17% westslope cutthroat genetic contribution. These hybrids are a serious threat to nonhybridized westslope cutthroat trout downstream of the waterfall. Removing the hybridized fish would be protective of a high conservation value westslope cutthroat trout fishery in the Blackfoot River watershed below, as fish easily move downstream over waterfalls. Protecting nonhybridized populations is the highest conservation priority for cutthroat trout in Montana and is imperative if westslope cutthroat trout are to persist into the future.

This project complements long-term conservation efforts in the Blackfoot River watershed. FWP, the USFS, BLM, USFWS, DNRC, NRCS, The Blackfoot Challenge, Big Blackfoot Chapter of Trout Unlimited, The Nature Conservancy, and landowners have been collaborating on projects to restore habitat, eliminate passage barriers, maintain in-stream flows, and prevent entrainment into irrigation canals. The North Fork Blackfoot River is one of the highest priority areas for native fish conservation in the Blackfoot River watershed and the presence of nonnative fishes is a primary threat to the stream's westslope cutthroat trout (Pierce et al. 2002).

State and federal agencies are authorized to implement projects to prevent further reductions of occupied habitat, restore populations when possible, and find secure habitat that is free of nonnative fishes and will remain cold enough to support westslope cutthroat trout into the future. Failing to conserve westslope cutthroat trout could lead to more drastic reductions of occupied habitat and put them at risk of extinction. The coevolved assemblage of fish and other aquatic species would be lost. Future generations would not have the opportunity to enjoy this native trout and experience unspoiled remnants of Montana's natural heritage.

The extent of westslope cutthroat trout loss in Montana justifies the need for action. Genetically unaltered westslope cutthroat trout populations occupy an estimated 11% of their historical habitat in Montana, and westslope cutthroat trout populations with less than 10% introgression with nonnative genes are present in 16% of their historically occupied habitat in Montana (FWP 2020). The amount of suitable habitat is expected to become concentrated at high elevations as climate change increases stream temperatures and reduces water supply (Isaak et al. 2015). The proposed project would offset losses of this Montana native by establishing them in protected habitat in the North Fork Blackfoot River, upstream of a barrier waterfall. Such projects provide secure habitat for westslope cutthroat trout and ensure this native fish will endure as part of the native ecosystem.

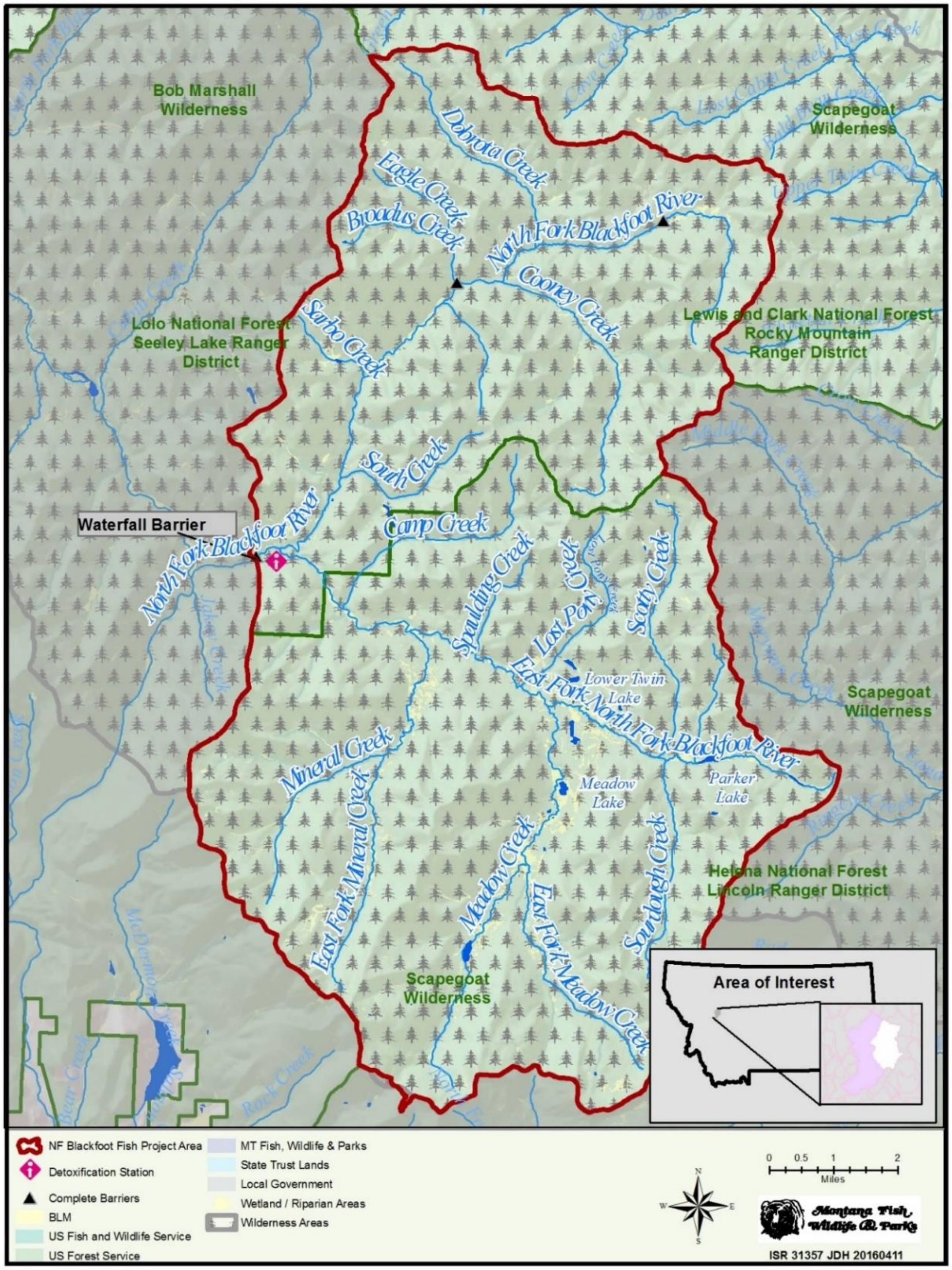

Figure 3. The North Fork Blackfoot River project area.

The North Fork Blackfoot River is an ideal setting to provide a haven where westslope cutthroat trout can persist well into the future. The North Fork Blackfoot River project area is isolated by natural barrier, has nearly 70 miles of perennial stream habitat, 3 connected lakes, and is at high elevation, which will likely remain cold enough to support these temperature sensitive species into the future (Isaak et al. 2015; Isaak et al. 2017). Climate change is constricting the habitat suitable for cold-water species like westslope cutthroat trout; high elevation environments present the few opportunities available to provide habitat that is expected to remain cold enough for their persistence.

1.2 *Goals of Proposed Action*

The goals of the proposed action are as follows:

- Establish a secure population of nonhybridized to slightly hybridized fish (< 10% hybridization) westslope cutthroat trout in the North Fork Blackfoot River upstream of the North Fork Falls (Figure 4); and
- Eliminate or substantially reduce a source of nonnative genes that are threatening westslope cutthroat trout throughout the Blackfoot watershed.

Figure 4. North Fork Falls at the downstream end of the project area.

Ideally, the proposed action would remove all fish in the project area; however, the size, remoteness, and complexity of the project area makes complete eradication challenging. Beaver impoundments, extensive wetlands connected to surface waters, and extreme habitat complexity from woody debris left from the 1988 wildfires challenge effective treatment with rotenone. Organic matter in many of the streams in this complex habitat would absorb rotenone, which would reduce its effectiveness. The size, remoteness and ruggedness of the project area requires a significantly-sized workforce and makes it logistically difficult to access the streams and transport personnel, equipment and supplies. These circumstances limit the feasibility and increase the expense and disturbance that would be required to completely eradicate the existing fishery.

Because of the probable difficulties in achieving full eradication of fish in the treatment area, reduction of nonnative hybrids to the extent that a population with < 10% hybridization would be acceptable. Although not a nonhybridized population, the project would provide a more robust fishery than what exists now. The hybrid trout are poorly adapted to the cold waters in the project area and present at lower densities than pure westslope cutthroat trout in adjacent backcountry drainages. For example, in the North Fork Blackfoot River in the project area, trout densities are 79 trout/mile, whereas in reference streams nearby, trout densities reach 603 trout/mile (FWP 2020). The stocked nonhybridized westslope cutthroat trout would be better adapted to project area, which could allow their genes to proliferate through natural selection and reduce the proportion of nonnative genes.

Although the waterfall currently blocks upstream movement of fish, the historical distribution of salmonids within the project area is uncertain, in part because extensive fish stocking has obscured genetic traces of preexisting *Oncorhynchus* fisheries (Pierce et al. 2018). The barrier falls may have prevented fish from accessing the project area; however, westslope cutthroat trout were present upstream of waterfalls or other natural barriers in the Blackfoot River watershed, such as Monture Creek and the Landers Fork (Pierce and Podner 2000).

Westslope cutthroat trout are present in neighboring watersheds in the Scapegoat Wilderness, and the divides between some adjacent drainages supporting aboriginal westslope cutthroat trout have low elevational separation. The headwaters of some streams in the North Fork Blackfoot River watershed are as little as 1000 linear feet apart. During historical geologic, climatic or hydrologic events, westslope cutthroat trout could have passed across these low divides into nearby adjacent watersheds. The proximity of headwaters populations of westslope cutthroat trout and the distribution of westslope cutthroat trout genes throughout the watershed, not just near formerly stocked lakes, suggest they may have been present in the North Fork Blackfoot River upstream of the barrier waterfall historically. However, the available fish survey and genetic data can neither confirm nor refute fish presence before historical stocking.

Under the conservation agreement for cutthroat trout in Montana (MCTSC 2007), reestablishing lost populations is a conservation priority as is establishing populations in historically fishless waters within the species' historical range, unless introduction of fish would negatively affect other native species. As the presence of westslope cutthroat trout in the project area before stocking of nonnative trout occurred is uncertain, it is unknown if this project would restore westslope cutthroat trout to their historically occupied habitat or expand their distribution within their historical range.

1.3 ***Relevant Plans***

Conservation and restoration planning for westslope cutthroat trout include documents prepared by state and federal agencies, and collaborative efforts among agencies (Table 1). These documents describe management, conservation, and restoration goals for westslope cutthroat trout, listed or sensitive wildlife species, or criteria for maintaining the natural or aesthetic values of the surrounding landscape.

Collaboration among entities is another component of the westslope cutthroat trout recovery plan. Agency collaborators for this project include FWP, NRDC, the USWFS, the USFS and the Lolo and Helena national forests. Montana Trout Unlimited and the Big Blackfoot Chapter of Trout Unlimited would help with public outreach, field support or funding.

Table 1. Planning and strategy documents with relevance to establishing westslope cutthroat trout in the North Fork Blackfoot River.

Agency	Citation	Website
FWP	Statewide fisheries management plan 2019	http://fwp.mt.gov/fishAndWildlife/management/fisheries/statewidePlan/
FWP	White paper: removal of fish using chemical and mechanical removal: methods, effectiveness, and environmental effects	http://fwp.mt.gov/news/publicNotices/decisionNotices/pn_0911.html
Montana Cutthroat Trout Steering Committee (MCTSC)	Memorandum of understanding and conservation agreement for westslope trout and Yellowstone cutthroat trout in Montana (MCTSC 2007)	http://fwp.mt.gov/fishAndWildlife/management/yellowstoneCT/
FWP	An integrated stream restoration and native fish conservation strategy for the Blackfoot River basin	Internal document
FWP		https://myfwp.mt.gov/fishMT/reports/surveyreport
FWP	Wild Fish Transfer Policy (FWP 1996)	http://fwp.mt.gov/fishAndWildlife/management/westslopeCT/default.html
FWP	Piscicide Policy (FWP 2017)	Internal document
U.S. Congress	The Wilderness Act of 1964	https://www.gpo.gov/fdsys/pkg/STATUTE-78/pdf/STATUTE-78-Pg890.pdf
FWP	Investigations to guide planning for bull trout and westslope cutthroat trout in the North Fork Blackfoot River upstream of North Fork Falls	http://fwp.mt.gov/news/publicNotices/decisionNotices/pn_0911.html
U. S. Congress	Endangered Species Act	https://www.fws.gov/endangered/laws-policies/

The last remaining plans address FWP's piscicide policy (FWP 2017), which has provisions to minimize adverse effects on the ecological and human environment, and monitor aquatic life before and after treatment. The wild fish transfer policy (FWP 1996) eliminates potential for spread of disease associated with translocating fish, fry, or fertilized eggs. The proposed alternative would follow these protocols.

The proposed project area is in the Scapegoat Wilderness. The USFS will evaluate the potential for the project to affect wilderness values in their scoping effort, which will run concurrently with the public comment period of this EA.

1.4 *Overlapping Jurisdictions & Authority*

The project area is within Montana, the Scapegoat Wilderness, and the Helena and Lolo national forests, which gives jurisdiction and authority to FWP and the USFS in implementing the proposed project. Because the project crosses several jurisdictional boundaries, authority to conduct this project comes from several sources. In Montana, authority comes from the following requirements under Montana Code Annotated (MCA 87-1-702; MCA 87-1-201[9][a]), which direct FWP to:

- Perform such acts as may be necessary to the establishment and conduct of fish restoration and management projects;
- Manage wildlife, fish, game and nongame animals in a manner that prevents the need for listing under 87-5-107 or under the federal Endangered Species Act, 16 U.S.C. 1531, et seq;
- Manage listed species, sensitive species, or a species that is a potential candidate for listing under the federal Endangered Species Act, U.S.C. 1531, et seq., in a manner that assists in the maintenance or recovery of those species.

1.5 *Estimated Commencement Date:*

Full piscicide treatment would likely occur in summer through early fall of 2021, unless wildfire or weather prevent treatment. Electrofishing, eDNA sampling, or both would be used to evaluate the effectiveness of fish removal and inform future management actions and stocking plans. Planting westslope cutthroat trout would occur from 2021 through 2025.

1.6 *Consultation*

Preparation of this EA included consultation with several entities. On January 22, 2020, FWP sent a letter to the Confederate Salish-Kootenai tribes, alerting them to this project, and soliciting comment on the potential for the project to harm cultural resources or resources with religious value.

FWP's piscicide policy (FWP 2017) requires consultation with the Montana Natural Heritage Program (MNHP) when an S1 or S2 invertebrate species of concern with an aquatic life history stage has been documented in the project area. The MNHP evaluates the risk that the project poses to the species and prescribes a mitigation plan to limit the effects of treatment on this species. Stonefly nymphs of the genus *Utacapnia* were collected in pre-project sampling (Pierce et al. 2015). The Columbian stonefly (*Utacapnia columbiana*) is an S2 species of concern given its rarity in Montana. Members of this genus of small winter stonefly cannot be identified to species in larval form. The timing of emergence as adults is in late winter through early spring, which makes verifying species infeasible given the broad window of emergence and need to travel into remote wilderness during winter. Bryce Maxell, zoologist and program manager from the MNHP, recommended assuming Columbian stoneflies were present. See section Potential Effects on Species of Special Concern and Sensitive, Threatened or Endangered Species for review of how the proposed action would affect the Columbian stonefly.

2 ALTERNATIVES

2.1 *Alternatives Considered*

2.1.1 Alternative 1: Proposed Action

The proposed action would greatly suppress a source of rainbow trout genes to the Blackfoot River watershed and establish a conservation population (<10% hybridization) of westslope cutthroat trout in the North Fork Blackfoot River watershed upstream of a barrier falls (Figure 5). Application of liquid rotenone would remove or greatly suppress the existing fishery, which includes hybrids of rainbow trout, Yellowstone cutthroat trout, and westslope cutthroat trout, with rainbow trout genes being predominant (Pierce et al. 2018).

Rotenone is a naturally occurring substance derived from roots and stems of tropical plants in the pea family, including jewel vine (*Derris* sp.) and lacepod (*Lonchocarpus* spp.). Rotenone-bearing plants are native to Australia, southern Asia, Pacific island chains, and South America. Native people discovered its utility in killing fish and have used it for centuries to obtain fish for food. Rotenone has been part of fisheries management in North America since the 1930s.

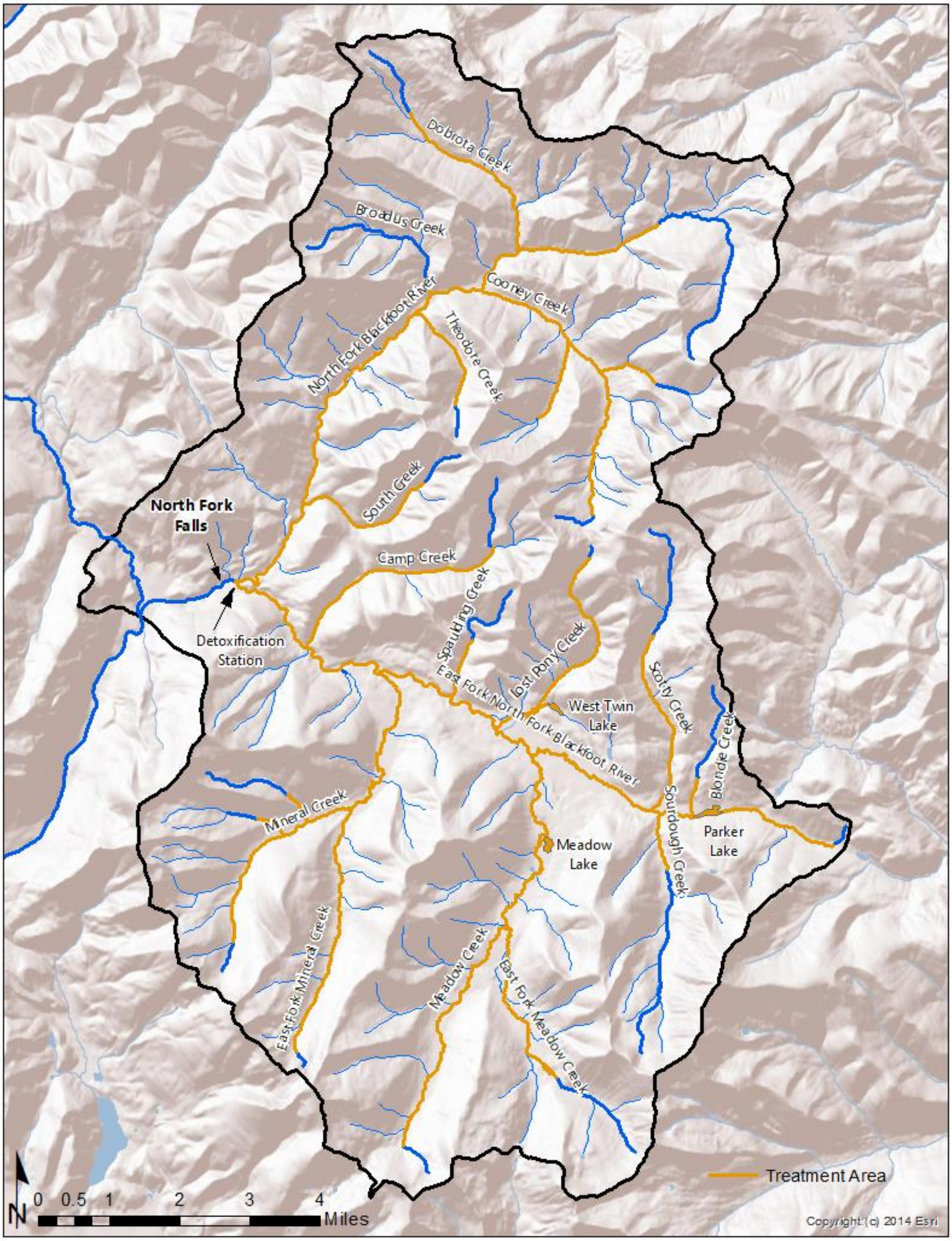

Figure 5. Current estimated distribution of fish in the proposed project area.

Rotenone dissolved in water enters fish through a thin layer of cells in the gills. This route of entry makes rotenone effective in killing fish at exceptionally low concentrations. Rotenone kills fish by preventing cells from turning fat, glucose, and proteins to energy. Some aquatic invertebrates and gilled amphibians are vulnerable to rotenone at concentrations used in fish management projects; however, strategic timing of application and using the lowest effective concentration would minimize the toxicity of rotenone to these organisms (Finlayson et al. 2010; Vinson et al. 2010; Skorupski 2011). Mammals, birds, reptiles, and other non-gill respiring organisms do not have this rapid route into the bloodstream; therefore, the concentration of rotenone used in fisheries management does not affect these animals.

Liquid rotenone would be applied to fish-bearing waters in the watershed. Initial estimates of 45 miles of occupied habitat (Pierce et al. 2018) have been adjusted to 67 miles of occupied habitat (Figure 5), as additional sampling, including the use of eDNA, has expanded the known distribution of fish in the watershed. About 18 miles of headwater stream do not support fish and would not be treated with rotenone

Three connected lakes would also be treated with rotenone (Figure 5). Parker Lake is on the East Fork North Fork Blackfoot River and has a volume of 69 acre-ft. Lower Twin Lake is in the Lost Pony watershed and has a volume of 30 acre-ft. Meadow Lake is in the Meadow Creek watershed, and has a volume of 18 acre-ft. Each lake currently supports hybridized fish, with evidence of stocking of rainbow trout and Yellowstone cutthroat trout.

Typically, streams targeted for chemical removal of nonnative fish species are treated for at least two consecutive years, and sometimes three; however, numerous factors present substantial challenges that make a single treatment with the goal of major suppression rather than eradication of nonnative *Oncorhynchus* the selected goal. The complexity of the habitat and richness of organic matter would require multiple treatments over several years and considerable amount of chemical to achieve full eradication of the existing fishery. Transporting field crews, chemicals, equipment, and personal gear into remote wilderness for several years would be expensive and disruptive to wilderness values. Given the challenges in achieving a total fish kill, recognition of the extent to which a multi-year chemical removal effort would affect wilderness values, and the presence of low levels of nonnative genes downstream of the project area, treatment in a single year would greatly reduce the number of *Oncorhynchus* hybrids in the project area. Achieving the goal of a conservation population with <10% nonnative genes would require repeated basin-wide stocking of nonhybridized westslope cutthroat trout.

The primary means of dispensing liquid rotenone to streams would be from drip stations or IV bags in accordance with all established label requirements. Drip stations are 5-gallon containers filled with the appropriate quantity of liquid rotenone diluted with stream water (Figure 6) and 5-liter IV bags are loaded with concentrated liquid rotenone that is dripped into the stream at the appropriate rate (Figure 7).

Pilot study investigations in 2018 provided the basis for determining the proposed concentrations of CFT Legumine to be used in the project area (Clancey et al. 2018). The pilot studies included bioassays that determine the travel time duration of toxic concentrations of rotenone using a default concentration of 1 ppm CFT Legumine, which yields 50 ppb of rotenone. Based on the results of the bioassays, concentrations of rotenone formulation can be adjusted to higher or lower concentrations with the objective of using the least amount of chemical to achieve project goals. Concentrations must not exceed limits set in the manufacturer’s label. The pilot studies also determined the concentration of potassium permanganate required to deactivate rotenone within 30 minutes travel time (Clancey et al. 2018).

Figure 6. Drip station dispensing diluted CFT Legumine.

Figure 7. IV drip bag applying undiluted liquid rotenone formula to a stream.

Streams in the project area are rich in organic matter, and abundant debris jams impede flows, allowing rotenone time to bind with organic matter. In some streams, toxic concentrations of rotenone did not travel for more than 30 minutes. Therefore, as allowed by the manufacturer's label and FWP's policy (FWP 2017), concentrations of rotenone formulation would be adjusted upward in some streams while being consistent with the goal of using the least amount of chemical needed to achieve project objectives and not exceeding the maximum allowed by the manufacturer's label. Results of the travel time study varied throughout the project area, so application concentrations would be stream specific. Application concentrations would range from 1 ppm to 4 ppm of liquid formulation, which is within the allowable limits under the manufacturer's label. Likewise, spacing of drip stations would be stream specific and informed by the travel time bioassays performed in these streams.

To achieve the desired instream concentration of rotenone, a specific volume of liquid rotenone is placed in the 5-gallon drip station and diluted with stream water to a capacity of 5 gallons. This mixture is trickled into the stream at a specific rate of about 80 ml/minute, which will evacuate the entire contents in about 4 hours. The 5-liter IV bags drip undiluted liquid rotenone into the stream at a specific rate to achieve the desired concentration. The drip rate is controlled by increasing or decreasing the height between the stationary bag and the distal end of the outflow tubing. Increasing the height increases the drip rate while decreasing the height decreased the drip rate. Fieldworkers with backpack sprayers would apply diluted liquid rotenone to off-channel waters, such as wetlands and isolated pools. A rotenone-sand matrix may be placed at the mouths of tributaries or seeps too small to treat with a drip station or IV bag to prevent fish from finding refugia from lethal concentrations of rotenone.

Fieldworkers would access designated points on streams by hiking or by horseback. Local outfitters, the USFS and FWP would transport gear and field workers into more remote sites. A helicopter would transport potassium permanganate, generators and associated supplies to the deactivation site upstream of the North Fork falls. The necessary equipment and supply distribution could be accomplished with about 10 flights in and out of the wilderness over a maximum of 2 days, and 5 flights over a maximum of 2 days to remove gear after the project has been completed.

Rotenone would be applied in lakes from a small inflatable raft. Parker Lake is largest of the lakes proposed for treatment and would require two inflatable rafts powered by small gas-powered outboard motors to ensure that rotenone application is completed in one day. A single oar-powered raft would be used to treat Meadow and West Twin lakes. A small battery powered pump on each raft would be used to disperse piscicide from the pesticide tank into the lake.

Rotenone in lakes would break down naturally through photolysis, by binding with organic matter, or by dilution with inflows of surface and groundwater. Toxic concentrations of rotenone could persist for days to weeks. Westslope cutthroat trout of catchable size would be planted in the 3 lakes by autumn 2021 following rotenone treatment to provide recreational angling opportunities until fish populations recover. If lake toxicity precludes stocking in the autumn after treatment, stocking will occur in the following summer after lakes thaw.

Rotenone would be deactivated just downstream of the confluence of the North Fork Blackfoot River and East Fork North Fork Blackfoot River (Figure 3) using potassium permanganate, a strong oxidizer which can neutralize rotenone within ½ hour of contact time within the stream. The procedure for deactivation on this project will be dictated by label requirements and more stringent FWP protocols (FWP 2017). It will likely require multiple days of application—a minimum of 2 and possibly 4 or more days. Deactivation must begin when rotenone is applied to the water at travel times less than 8 hours upstream of the deactivation station, and then must continue after the rotenone treatment ceases until a time that sentinel fish at the deactivation station can survive four hours without stress.

In streams, dead fish would be left to decompose, which would provide the nutrients to foster recovery of stream invertebrates. In cold-water lakes or those with temperatures < 58 °F, fish tend to sink (Parker 1970; Bradbury 1986). Nevertheless, some fish carcasses do not sink and are carried by wind and wave action to lake shores. If excessive accumulation of fish carcasses occur along shores, personnel may need to retrieve those fish to pop their air bladders and sink them in the deepest offshore area of the lake.

Following piscicide treatment, nonhybridized westslope cutthroat trout would be stocked in the North Fork Blackfoot River watershed. FWP's westslope cutthroat trout brood stock has been proven to be successful in populating watersheds and have outperformed westslope cutthroat trout from wild stock (Andrews et al. 2016) likely due to their greater genetic diversity than most remaining wild stocks. Periodic infusion of wild genes promotes genetic diversity and swamps out genes selected for in the hatchery environment that would be maladaptive in the wild. Natural selection further works to eliminate genes favored in the hatchery environment.

Within fish-bearing streams, stocking would commence at the furthest upstream location of suitable fish habitat. Sections of streams above known passage barriers would not be stocked in order to preserve their fishless condition (A). Lakes and the main stems of the East Fork North Fork Blackfoot River and North Fork Blackfoot River, and larger tributary sections would be stocked by aircraft during the first stocking event. Where canopy cover limits the ability to stock from a helicopter, fish would be distributed on foot or by pack stock. Some of the fish tanks for these stocking events may need to be flown in and then dispersed throughout the project area using foot and stock methods. Locations closer to the trailheads that require manual stocking can probably use stock to transport the fish tanks into the project area. Ideally, the first stocking event would occur in autumn after treatment has been completed. Stocking would occur for a minimum of three years within a 5-year span and include multiple age classes to establish a recreational fishery and expedite the spawning activity of nonhybridized fish in the project area. Aerial stocking will be reduced in the outyear stocking events and rely primarily on horse or mule assisted stocking. A maximum of 7 flights in each of the two outyears is required to accommodate stocking fish of the larger size class.

Posttreatment monitoring is an essential component of piscicide projects (Meronek et al. 1996). Monitoring of stream-dwelling macroinvertebrates and amphibians would exceed the requirements under FWP's piscicide policy (FWP 2017), which calls for checking the list of species of special concern at least 1 year in advance of the anticipated project date. FWP and MHNP conducted aquatic macroinvertebrate and amphibian surveys basin-wide several years in advance of the projected date of piscicide treatment (Pierce et al. 2015) and consulted the list of species of special concern. Posttreatment monitoring would follow the same protocols as the pretreatment sampling.

Project collaborators would evaluate the success of chemical removal of hybrid trout and establishment of a westslope cutthroat trout conservation population soon after the treatment. Monitoring would include a combination of electrofishing, snorkeling, genetic testing, eDNA collection, and gillnet surveys. Posttreatment monitoring would likely occur for at least 10 years. Monitoring at pre-treatment survey sites will provide a robust evaluation of project effectiveness (Pierce et al. 2015). Likewise, gillnet surveys would be repeated in the three fish-bearing lakes to determine project effectiveness. Genetic analyses will help inform the success of rotenone application and determine if adjustments to the stocking plan are necessary to accomplish project objectives. Additional monitoring will include benthic invertebrates and amphibians in streams and zooplankton in fish-bearing lakes at the same locations as pretreatment sampling (Pierce et al. 2015)

2.1.2 Alternative 2: No Action

Under the no action alternative, agencies would not remove the existing fishery and replace it with native westslope cutthroat trout. This alternative would not yield conservation benefits for native species, reduce the threats of hybridization posed by rainbow trout hybrids spilling over the falls, or contribute towards the goals and objectives for restoration, protection, or conservation of westslope cutthroat trout. The overall distribution of westslope cutthroat trout would continue to contract as nonnative rainbow trout hybridize with westslope cutthroat trout and brook trout displace them from occupied habitat (Shepard 2010). Climate change would continue to restrict suitable habitat for westslope cutthroat trout through warmer temperatures and reduced water supply (Knowles et al. 2006; Isaak et al. 2015; Isaak et al. 2017).

2.2 *Alternatives Considered but Dismissed*

2.2.1 Genetic Swamping

Under this alternative, piscicide would not be applied throughout the project area. Instead, large numbers of nonhybridized westslope cutthroat trout would be stocked for multiple years throughout the project area. Frequent stocking and successful reproduction by nonhybridized westslope cutthroat trout can change the genetic structure of the populations over time (Leary et al. 2006); however, successful use of swamping has been limited to small, headwater lakes with limited spawning and juvenile rearing habitats. Genetic swamping in lakes in the South Fork Flathead watershed occurred for over 20 years and had variable success (Grisak 2003; Leary et al. 2006; Boyer et al. 2010). No case studies involving large-scale applications of genetic swamping in stream systems have been documented.

The feasibility of swamping nonnative genes in a large, connected watershed is doubtful given the potential number of fish needed, necessary duration of swamping efforts, and the capacity of hatcheries to supply enough fish for potentially decades of effort. In the South Fork Flathead River watershed, swamping was conducted by stocking at three times the typical stocking rate used in high elevation mountain lakes in the drainage (Boyer et al. 2015). Applying this stocking rate to stream swamping is likely conservative, as the lakes represent relatively simple and confined habitat, whereas the streams systems are dynamic and complex and might require a more intensive swamping prescription. An average stream stocking rate of 0.36 fish per meter (0.11 fish/foot) was successful in the Cherry Creek watershed in southwest Montana after full eradication of nonnative fishes (Clancey et al. 2019). Applying the three-fold factor to this stocking rate, over 116,000 trout would need to be stocked throughout the 67 miles of habitat on an annual basis, until the goal of a conservation population with < 10% of nonnative genes is established. Not only would planting these fish be challenging and require significant helicopter and stock support, but the need is about half of the current hatchery output for the Washoe State Hatchery (Smith 2020) and would severely curtail stocking in other waters in the state for the 10 to 20 years necessary to accomplish the project goal.

Piscicide application has an extensive record of proven success for these scenarios, whereas genetic swamping on this spatial scale would be experimental, labor intensive, and expensive. Therefore, the preferred alternative of piscicide application with the immediate stocking of nonhybridized fish afterwards provides the efficacy of a piscicide treatment, but also leverages the benefits of swamping to reduce hybrid genes from the few fish that area likely to remain in certain sections of the project area.

2.2.2 Treat with Rotenone for Multiple Years

This alternative differs from the preferred alternative in that rotenone treatments would occur for two or more consecutive years. When complete eradication of the existing fishery is the goal, repeat treatment in subsequent years is standard practice; however, the goal of this project is suppression, not eradication. Treatment in one year frequently does not achieve a full fish kill, especially when habitat is complex. Nevertheless, the initial treatment does achieve substantial mortality, and subsequent treatments kill far fewer fish. For example, in Soda Butte Creek, about 450 brook trout were killed after the first treatment, and only two brook trout were observed during the second-year treatment (Ertel et al. 2017). The modest gains in fish mortality when eradication is not the goal does not justify the expense, effort, and repeated disturbance in designated wilderness resulting from additional years of treatment.

Treatments in subsequent years would delay stocking of unhybridized westslope cutthroat trout into the project area, which would occur soon after treatment under the proposed action. Fish remaining in the project area would reproduce between treatments, and some of their progeny may survive subsequent treatments. Under the proposed action, basin-wide stocking would swamp the few remaining *Oncorhynchus,* which would further decrease their prevalence in the project area. Overall, this alternative would bring considerable expense and disturbance with little biological benefit compared to the proposed action.

2.2.3 Treat with Rotenone and Not Stock Westslope Cutthroat Trout

Under this scenario, application of rotenone would substantially suppress the rainbow trout hybrids in the project area as described for the proposed action, but westslope cutthroat trout would not be planted in the project area. The rationale for this alternative is that the historical state may have been fishless and being fishless would be consistent with perceived wilderness values. This alternative has numerous problems that make it an undesirable action.

Uncertainty over the potential for westslope cutthroat trout to have been present in the project area is a consideration. Westslope cutthroat trout upstream of barrier falls in neighboring watersheds suggest westslope cutthroat trout could have been in the project area, and basin-wide distribution of westslope cutthroat trout genes (Pierce et al. 2018) may be indicative of a relict population of westslope cutthroat trout that was swamped out through nonnative fish introductions over decades. Westslope cutthroat trout are present in the neighboring Landers Fork watershed upstream of a waterfall, and the horizontal divide between waters in these watersheds is around 1,000 feet in places. The proximity of naturally fish-bearing waters streams to the North Fork Blackfoot River is supporting evidence of the potential for the North Fork Blackfoot River to have supported westslope cutthroat trout historically.

Fishless waters have inherent ecological value that needs to be considered when placing fish upstream of barriers. Assuming the project area was fishless before introduction of nonnatives, the character of that fishless state is unknowable and lost, as rainbow trout and Yellowstone cutthroat trout have been present for decades (Pierce et al. 2018). The introduction of rainbow trout may have altered the benthic assemblage and interactions with riparian species, as nonnative trout are functionally different predators than native trout (Benjamin et al. 2011; Lepori et al. 2012). Conversely, no known species of invertebrate or amphibian inhabiting waters capable of supporting fish has not coevolved with westslope cutthroat trout. Despite living in a fishless area, invertebrates and amphibians readily disperse among fishless and fish-bearing waters. Therefore, removing fish would be unlikely to achieve a pre-settlement character of the streams' ecology, nor is this character known.

2.2.4 Mechanical Suppression

Under this alternative, project partners would attempt to eradicate rainbow × cutthroat trout hybrids by removing fish captured using electrofishing. The large spatial extent of fish occupied waters and habitat complexity throughout these streams would make electrofishing an infeasible means of suppressing existing fish populations. Dead fall timber from the 1988 wildfires cover many of the smaller tributaries and results in extreme complexity of the habitat and obscures a large amount of stream channel (Figure 8). Mechanical removal in these reaches would be exceedingly ineffective. A comparison of mechanical versus chemical removal with emphasis on projects in designated wilderness provides a detailed assessment of both approaches and confirms that mechanical removal would not be effective, would increase trammeling in wilderness, and would have negative consequences for streams and aquatic life (Endicott 2017) .

2.2.5 Angling

Angling is an inefficient means to eradicate fish from streams. Unlike piscicide, anglers cannot target young-of-the-year fish. Furthermore, many of the tributaries are steep, small streams with abundant deadfall timber that severely limits access to some streams (Figure). Few anglers would desire to fish these waters given the difficulty in accessing them and the relatively low abundance and small size of the fish. Any reductions in fish numbers from angling would free resources for the next generation of rainbow trout. Angling would not achieve the needed level of suppression of rainbow trout hybrids to protect westslope cutthroat trout in the watershed below the project area or achieve a slightly hybridized population of westslope cutthroat trout in the project area.

Figure 8. Typical view of large woody debris and associated habitat complexity due to deadfall timber from the 1988 wildfires.

2.2.6 Introduction of Bull Trout to Project Area

The project area has considerable potential to support bull trout, which are protected under the Endangered Species Act as a threatened species. Bull trout are especially vulnerable to climate change, and the project area has substantial potential to retain a suitable thermal regime into the future (Isaak et al. 2017). Many sections of the drainage above the falls are ranked as highly suitable for bull trout (Pierce et al. 2018). Bull trout would benefit from the extensive, connected, and diverse habitat. Furthermore, the large drainage area above the falls allow bull trout to exhibit migratory life histories. Introducing bull trout would not require the use of rotenone, so it is not being considered under the current scope of this project phase.

Introduction of bull trout will be considered as a proposed action in a separate environmental analysis and is considered a desirable future condition for the area upstream of the falls (Pierce et al. 2002). Its status as a threatened species brings the need for considerable consultation, which would delay removal of the hybrids that are a threat to westslope cutthroat trout in the watershed downstream. Addressing bull trout introduction as a separate component maintains clarity that the rotenone application and westslope cutthroat trout stocking are a combined project element. Bull trout are under the broader umbrella of the North Fork Blackfoot River native fish conservation project but are not related to this proposed rotenone application. Therefore, the project planning, project development, and subsequent environmental analysis should occur in a concurrent, but separate analysis. Given the complexities with identifying a donor stock, developing a hatchery program, and fulfilling the environmental analysis, addressing bull trout introduction in a separate process will prevent time consuming aspects and unforeseen challenges from delaying the westslope cutthroat trout conservation project implementation.

3 AFFECTED ENVIRONMENT AND PREDICTED ENVIRONMENTAL CONSEQUENCES

3.1 ***Land Use***

3.1.1 Alternative 1: Proposed Action – Land Uses

As the project area is in designated wilderness, logging, road construction, and grazing would not be affected, although the proposed action has potential to influence hunting and angling. The rotenone application is planned to be completed before the September 15 beginning of the popular early rifle season in the wilderness. Depending on persistence of rotenone toxicity in lakes, hatchery availability, and helicopter availability, stocking may continue throughout and after hunting season. The proposed action could extend into the archery and upland bird season, and fieldworkers could displace wildlife and be a nuisance to hunters. Fieldworkers would be traveling along stream corridors and camping at established locations, which would leave most of the landscape free from this disturbance. Moreover, agencies regularly conduct fisheries fieldwork into hunting season, so this project would not present a new disturbance for hunters. Overall, this work would result in short-term and minor effects on hunting. The stocking event in 2021 will commence as soon as possible after waters become neutralized, so every effort will be made to minimize the effects on disrupting hunters. Stocking events after 2021 will occur in early to mid-summer, so hunters will not be disturbed.

Because of generally low trout abundance, the project area provides limited angling opportunities to hikers and those who pack in on horseback. Nevertheless, these waters provide anglers with opportunities to fish in the tranquility, remoteness, and beauty of designated wilderness, which is a rare and special outdoor experience. Replacing the existing fishery with native species adapted to the cold-water regime would likely improve angling within the project area. The proposed action is a native fish conservation project; however, anglers would also benefit from the locally-adapted native fishery. In another large-scale westslope cutthroat trout restoration project in Montana, westslope cutthroat trout rapidly repopulated the project area, and their abundance was greater than the nonnatives they replaced (Clancey et al. 2009). Westslope cutthroat trout are likely better adapted to the cold, nutrient poor waters in the project area than the *Oncorhynchus* hybrids and likely respond similarly in the project area making the reduction in fish short-term and the westslope cutthroat trout would achieve greater numbers and biomass than what is currently present.

To mitigate for the loss of angling in lakes, FWP would plant multiple size classes of westslope cutthroat trout, including catchable sized trout, to establish an immediate and sustainable recreational fishery in Parker, Lower Twin, and Meadow lakes after rotenone had broken down and would no longer be toxic. Fish stocking would provide an immediate source of fish for recreation and mitigate for loss of angling that would adversely affect outfitters.

The short-term reduction of fish in the project area could limit the enjoyment of a resource currently available in this wilderness area, which may be unpopular with some visitors to wilderness. Agency response would be to include informational meetings and press releases alerting anglers to the temporary elimination of fish and explanation of the conservation benefits of establishing native westslope cutthroat trout in the area. This EA's public comment period would expand the outreach to anglers, conservationists, and anyone else with interest in the North Fork Blackfoot River watershed.

Planting westslope cutthroat trout would compensate for the loss of the existing fishery. At a minimum, fish populations would likely replace the removed species in terms of abundance or biomass (Shepard 2010). Potentially, by stocking locally adapted fish, the abundance and distribution of native trout would increase within the project area, when compared to the limited distribution, low density, and small size of fish currently present. Therefore, an improved angling experience would be a potential outcome of this native fish restoration project.

Although this project is foremost a native fish conservation project, wildlife that consume fish, especially grizzly bears, osprey, mink, and bald eagles would also benefit from the higher density of trout in the project area. Visitors to the Scapegoat Wilderness may have greater potential for wildlife viewing with the greater forage base provided by the locally adapted westslope cutthroat trout.

3.1.2 Alternative 2: No Action

Land uses would be unaffected by the no action alternative.

3.1.3 Cumulative Effects of Alternatives on Land Use

Implementing the proposed action would have minor and short-term effects on land uses in the North Fork Blackfoot River watershed, and no cumulative effects on existing land uses would be expected. The temporary reduction of fish would result in a lack of fishing opportunities until project completion, and the native fishery is established. Signs posted at trailheads would educate anglers about the project, so they do not fish fishless waters. The treated lakes would be restocked with catchable westslope cutthroat trout as soon as possible after treatment to restore angling opportunities in those three waterbodies. The no action alternative would have no effect on current land uses.

3.2 ***Soils***

3.2.1 Alternative 1: Proposed Action

Soils would be unaffected by the proposed action.

3.2.2 Alternative 2: No Action

The no action alternative would not affect soils.

3.2.3 Cumulative Effects on Soils

Neither alternative would affect soils.

3.3 ***Vegetation***

3.3.1 Alternative 1: Proposed Action—Vegetation

Under the proposed action, fieldworkers and pack animals would be in the project area. Fieldworkers would trample vegetation: however, this disturbance would be short-term, minor, and limited to camping areas, the riparian corridor or near trails. Horses and fieldworkers have the potential to spread noxious weeds from feed and clothing. Requiring certified weed free hay and mandatory removal of weeds from clothing, footwear, and equipment would greatly reduce the potential for the spread of noxious weeds.

The MNHP database lists several plant species of special concern observed in the Scapegoat Wilderness with potential to be in the project area (Table 2). Review of field guide information in the MNHP database indicates plant species of special concern would experience short-term and minor disturbance, or no disturbance. Rotenone is not toxic to plants at concentrations applied in fish management projects, so any disturbance would relate to the presence of field crews. Scorpidium moss is a species of special concern that occurs in the Scapegoat Wilderness, and occupies wet soils in calcareous seeps, fens, bogs, ponds, and other wetlands. Although Scorpidium has not been documented within the project area, its habitat is present, and taking preventative measures are warranted. Trampling by fieldworkers applying piscicide in wetlands would be the only type of disturbance to Scorpidium moss if present. To mitigate for any disturbance, fieldworkers treating areas likely to support this moss would be provided field guide information and would be instructed to take care to avoid trampling Scorpidium moss. Nonetheless, any trampling would be short-term and minor, and the potential for widespread disturbance would be extremely low.

Table 2. Plant species of special concern in the Scapegoat Wilderness.

Class	Scientific Name	Common Name	State Rank	USFS Status
True Mosses	*Scorpidium scorpioides*	Scorpidium moss	S2	Sensitive
Dicots	*Erigeron lackschewitzii*	Lackschewitz's Fleabane	S3	Sensitive
Dicots	*Cardamine rupicola*	Cliff Toothwort	S3	
Dicots	*Drosera anglica*	English Sundew	S3	Sensitive
Dicots	*Drosera linearis*	Slenderleaf Sundew	S2	Sensitive
Monocot	*Schoenoplectus subterminalis*	Water Bulrush	S3	Sensitive
Monocot	*Cypripedium passerinum*	Sparrow's-egg lady's-slipper	S2S3	Sensitive

Definitions of Status Codes and Descriptors
S2 = At risk because of very limited and/or potentially declining population numbers, range and/or habitat, making it vulnerable to global extinction or extirpation in the state.
S3 = Potentially at risk because of limited and/or declining numbers, range and/or habitat, even though it may be abundant in some areas.
S2S3 = Indicates that populations in different geographic portions of the species' range in Montana have a different conservation status *(e.g., S1 west of the Continental Divide and S4 east of the Continental Divide).*

Two species of sundew have been observed in the Scapegoat Wilderness, but neither have been documented within areas slated for piscicide treatment. These plants occupy fens, which makes them susceptible to trampling during treatment of wetlands. The English sundew would be past its sensitive flowering and fruiting periods during late summer or early fall treatment, the proposed period for project. Slenderleaf sundew has potential to be within its fruiting life-history stage September, which would coincide with piscicide application. To avoid disturbance to these species, should they be present in the project area, fieldworkers treating wetlands would be provided photos and field guide information to avoid trampling these species of special concern.

Project activities have little to no potential to affect the remaining plant species of special concern. The areas where fieldworkers would be present do not provide habitat for these species. Moreover, project implementation would not coincide with their sensitive life-history stages.

3.3.2 Alternative 2: No Action

The no action alternative would not affect vegetation.

3.3.3 Cumulative Effects of Alternatives on Vegetation

For the chemical removal alternative, the presence of fieldworkers and horses would have a short-term and minor effect on vegetation. Trampling streamside vegetation would be the primary disturbance, although the presence of humans could introduce noxious weeds into the project area. Scheduling the project in late summer through early fall when most plants would be past their vulnerable, reproductive stages, would avoid detrimental effects on these species of special concern that are likely to be in the project area. Providing fieldworkers treating wetlands with field guide information on Scorpidium moss and slenderleaf sundew would reduce the potential for trampling these species of special concern during treatment. To reduce the potential for spread of noxious weeds, pack animals would be fed weed-free hay. The no action alternative would not affect vegetation. No cumulative effects on vegetation are expected with the implementation of either alternative.

3.4 *Wildlife and Fish*

3.4.1 Alternative 1: Proposed Action

Changes in the Diversity and Abundance of Game Animals and Birds

Given the wildness of the surrounding area, the project area supports an abundance of game species, including moose, elk, mule deer, white-tailed deer, black bear and gray wolf. Upland game birds including dusky grouse, ruffed grouse, and spruce grouse are also likely present.

Activities related to the proposed action would have short-term and minor effects on game species, but those activities would occur at varying places throughout the project area over the course of 3 – 4 weeks. The presence of fieldworkers would disturb game species within an area of work activity for several days until project activities moved to the next location. Most of the young of these species would be relatively mature, and capable of withstanding this short-term disturbance. Piscicide treatment would result in short-term and minor changes in water quality and forage base. These disturbances are described in detail in sections below.

Rainbow trout × Yellowstone cutthroat trout × westslope cutthroat trout hybrids are the game fish present in the project area. These would be drastically reduced in numbers over the short-term. Restocking with westslope cutthroat trout in 2021 after the rotenone treatment is completed will reestablish a fishery in lakes and streams. Full recovery of fish populations throughout the project area would likely take 3-6 years, which is roughly one to two westslope cutthroat trout generations (Shepard et al. 2018). Westslope cutthroat trout are better adapted to the project area than the hybrid fish and would be present in greater abundance and occupy more habitat than the existing hybrids.

Diversity or Abundance of Nongame Species

Mammals

A diversity of mammals are present in the project area, and the project would result in short-term and minor disturbance associated with presence of fieldworkers. Mammals would also have short-term exposure to rotenone, with ingestion of treated water or fish and invertebrates killed by rotenone being the primary routes of exposure. See 3.5 Water Resources for review of the research on low concentrations of applied rotenone and rapid breakdown of rotenone in the environment.

Exposure through eating dead fish and invertebrates or drinking treated water would not harm mammals. Likely scavengers of dead fish and invertebrates include mink, grizzly bears, black bears, wolves, otters, birds such as ravens, magpies, bald eagles, and golden eagles. The exceptionally low concentrations of rotenone in treated water and its strong tendency to break down and become absorbed to organic matter means wildlife would not receive doses that would be harmful. Species that consume fish or invertebrates of aquatic origin would experience short-term reduction in food availability. The species likely to eat fish are generalists in the feeding habits and can switch to other food sources. Moreover, reductions in aquatic invertebrates are slight to moderate (Skorupski 2011) leaving a substantial number of invertebrates for species like American dippers. The resurgence of numbers of `invertebrates in the weeks following piscicide treatment mitigate the slight to moderate reduction resulting from piscicide treatment. See Stream-Dwelling Aquatic Invertebrates for the review of effects of rotenone on invertebrate populations and their recovery.

A substantial body of research has explored the acute and chronic toxicity of rotenone and other potential health effects, and exposure to the concentrations in water and dead animals is far lower than concentrations that would be toxic (EPA 2007). Rotenone breaks down rapidly in the digestive tract of mammals (AFS 2002), and potential exposure to rotenone from fish removal projects is far lower than levels shown to result in acute or chronic toxicity. The concentration of active ingredient rotenone used for fish removal projects ranges typically from 0.025 – 0.2 ppm, which is equivalent to 25 ppb – 200 ppb. These concentrations are many times lower than concentrations found to be toxic. For example, a 22-pound dog would have to drink nearly 8,000 gallons of treated water or eat 660,000 pounds of rotenone-killed fish within 24 hours to receive a lethal dose (CDFG 1994). A half-pound mammal would need to eat 12.5 mg of pure rotenone, or drink 66 gallons of treated water within 24 hours to receive a lethal dose (Bradbury 1986).

Dead fish take up to 2 weeks to decay; however, this availability of dead fish would not result in exposure that would cause chronic toxicity, as rotenone has low toxicity when eaten and concentrations in fish tissue would be low and short-lived. In laboratory studies where rotenone was not subjected to environmental conditions that promote its breakdown, animals fed rotenone survived amounts that are far greater than is possible from fish removal treatments. Rats fed 75 ppm per day for over 2 years weighed significantly less than rats not fed rotenone and had smaller litters; however, this exposure did not result in mortality, birth defects, or cancer (Marking 1988). Likewise, dogs fed 200 mg of rotenone daily for 6 months weighed less than dogs not fed rotenone, ate less, and had diarrhea and mild anemia (Marking 1988). For rats and dogs, taste aversion was likely limiting their intake of food and contributing to the lower weights.

The dose and duration of exposures in these laboratory studies with rats and dogs (Marking 1988) were far greater than field exposure from drinking treated water or eating rotenone-killed fish or invertebrates. In trout streams in Montana, the effective concentration of active ingredient rotenone is generally 0.025 to 0.3 ppm and application at each drip station lasts 4 to 6 hours. Streams would have concentrations toxic to fish and some invertebrates for less than 24 hours. Rotenone would take longer to break down in lakes, but the concentrations would be orders of magnitude lower than the amounts of rotenone fed to dogs and rats that resulted in only minor health effects. Likewise, concentrations in dead fish and invertebrates would be minute and would quickly bind with the organic matter in the dead animal and be rendered nontoxic.

Other toxicological studies provide evidence that the proposed project would not result in chronic health problems for wildlife drinking water or eating fish carcasses. Rotenone exposure has not been shown to result in birth defects (HRI 1982), gene mutations (VanGoetham et al. 1981; BRL 1982), or cancer (Marking 1988). Rats fed diets containing 10 to 1000 ppm of rotenone over 10 days did not experience reproductive dysfunction (Spencer and Sing 1982). This combination of studies provides robust evidence that rotenone application to eradicate fish does not harm wildlife drinking water or eating dead fish or invertebrates.

Beaver dams are abundant in the project area, and these would be breached to reduce the amount of standing water to facilitate effectiveness of rotenone treatment. Full detail on beaver dam treatment are in the piscicide implementation plan (Appendix A). This disturbance would be short-term and minor. Beavers rapidly repair dams, and water levels would be restored within days after treatment.

<u>Birds</u>

Birds have potential to be exposed to rotenone through drinking treated water or scavenging dead fish and invertebrates. Like mammals, birds' digestive tracts rapidly break down rotenone. Furthermore, the concentration of rotenone in waters treated in fish removal projects is far lower than concentrations found to be harmful. A ¼-pound bird, which is smaller than an American crow, would have to drink 100 quarts of treated water or eat more than 40 pounds of rotenone-killed fish within 24 hours for a lethal dose (Finlayson et al. 2000).

Numerous species of birds rely on prey of aquatic origin, and rotenone has potential to temporarily decrease prey species. Fish numbers would be drastically reduced, which would limit fish as a food source. Fish-eating birds in the project area include kingfishers, bald eagles, osprey, and some waterfowl. These birds are mobile and can move to more productive feeding grounds until the fishery recovers. Restocking lakes and streams as soon as rotenone degrades would provide fish for fish-eating birds. If lake toxicity precludes stocking in the fall, they will be stocked the following summer. The duration of a fishless state would be limited, as these lakes would be iced over by late fall and remain covered by ice into spring.

Invertebrates would be slightly to moderately reduced in numbers, but recovery of invertebrate numbers and biomass is rapid (see Stream-Dwelling Aquatic Invertebrates). American dippers eat aquatic invertebrates and do not migrate. This species would have a short-term reduction in forage base followed by rapid recovery of biomass, then diversity, would make this a minor and short-term reduction.

Reptiles

Reptiles, especially gartersnakes, have potential to be exposed to rotenone-treated water and are among the likely scavengers of dead fish and invertebrates. The low concentration of rotenone in the water and dead fish would likely not result in toxic exposure to reptiles. Like in mammals and birds, rotenone would break down rapidly in the digestive tract of reptiles. The reptilian gut may be more efficient at breaking down the fragile rotenone molecule, as reptiles have capacity to digest bone, hair, and exoskeletons, all of which are far less degradable than the fragile rotenone molecule.

Amphibians

The project area supports four species of amphibian (Table 3). Amphibians are closely associated with water and have potential to be exposed to rotenone during piscicide treatment. Adult, air-breathing amphibians have low vulnerability to rotenone as applied at fish killing concentrations (Chandler and Marking 1982; Grisak et al. 2007; Billman et al. 2011; Billman et al. 2012), but gill-breathing larvae are vulnerable (Grisak et al. 2007; Billman et al. 2011; Billman et al. 2012). In the laboratory, tadpoles of Columbia spotted frogs and western toads died when exposed to 1.0 ppm of CFT Legumine for 96 hours (Billman et al. 2011).

Table 3. Amphibians observed in the North Fork Blackfoot River native fish conservation project area.

Common Name	Scientific Name	Gilled Phase Coincide with Proposed Treatment Timing?	State Status	USFS Status
Rocky Mountain tailed frog	*Ascaphus montanus*	Yes	S4	
Columbia spotted frog	*Rana luteiventris*	unlikely	S4	
Western toad	*Anaxyrus boreas*	unlikely	S2	Sensitive
Long-toed salamander	*Ambystoma macrodactylum*	No	S4	

S4 = In Montana, the species is apparently secure, although it may be rare in parts of its range, and/or expected to be declining.
S2 = At risk because of very limited and/or declining population numbers, range, and/or habitat, making it vulnerable to global extinction or extirpation from the state.
Sensitive = species for which population viability is a concern as evidenced by a downward trend in population or a significant downward trend in conservation concern designations on individual national forests.

Field investigations of amphibian populations after treatment of streams and lakes with rotenone have found amphibians to be resilient to rotenone treatment. In a treated lake and wetlands, the effects of rotenone on Columbia spotted frog tadpoles were short-term and minor, as they returned to or substantially exceeded pretreatment numbers the following year, and maintained those numbers for 3 years (Billman et al. 2012). Columbia spotted frogs have great reproductive potential and rebound dramatically after rotenone treatment. Despite near total mortality of Columbia spotted frog tadpoles during piscicide treatment in High Lake in the Specimen Creek watershed in Yellowstone National Park, Columbia spotted frog tadpoles were nearly triple pretreatment abundance in the 3 years following piscicide treatment (Billman et al. 2012). The high tolerance of adults to rotenone, the presence of numerous adult age classes, their substantial reproductive potential, lack of fish, and abundance of habitat and forage likely contributed to increased numbers of tadpoles compared to the pretreatment baseline.

Investigation of the response of amphibians to rotenone projects in 10 alpine lakes in Montana found no significant differences between abundance and species composition of amphibians counted 2 to 4 years before rotenone application and following rotenone application (Fried et al. 2018). This project area shared the same species of amphibian as the North Fork Blackfoot River project area. Treatment with rotenone in this large-scale project did not result in reduction of observations of Rocky Mountain tailed frogs, long-toed salamanders, western toads, and Columbia spotted frogs. This general resilience to rotenone treatment across amphibian taxa indicates amphibians have the ability to withstand rotenone projects under established protocols to limit mortality of nontarget organisms (FWP 2017; Finlayson et al. 2018).

Although species and life stages of amphibian may vary in their tolerance to rotenone, research in Norway yielded comparable results to the field studies in Montana (Amekleiv et al. 2015), suggesting a general tolerance of rotenone by frogs and toads in the same genera as Columbia spotted frogs and western toads. The common frog (*Rana temoraria*) and common toad (*Bufo bufo*), were present pretreatment, and eggs, tadpoles, and adults were in the lake the next year, leading the authors to conclude that CFT Legumine rotenone formulation had little effect on the amphibians in the treated lake.

The long-toed salamander is unlikely to experience long-term population effects of piscicide treatment. Long-toed salamanders usually lay eggs in fishless ponds or lakes, which would not be treated with rotenone. Even so, larval long-toed salamanders were 5 times more tolerant to Prenfish, a formulation of rotenone using organic solvents and dispersants, than fish, and adult long-toed salamanders survived 96-hour exposure to treatment concentrations of Prenfish used in piscicide projects (Grisak et al. 2007). Adult long-toed salamanders are terrestrial, and breed immediately after snowmelt, they would not be present for fall application of piscicide. The combination of preference for fishless lakes for breeding and terrestrial existence as adults make long-toed salamanders unlikely to be affected by piscicide treatments. In cases where this species breeds in fish-bearing lakes, piscicide treatment may result in the loss or reduction of a year class; however, breeding in following seasons would allow the population to recover. Additionally, the piscicide treatment of the lake would likely result in significantly fewer or no fish that may prey on the juveniles.

Consultation with the senior zoologist at MNHP indicated benefits to amphibians with removal of nonnative fish (Bryce Maxell, MNHP, personal communication). Amphibians coevolved with native fish species, and their populations are likely to benefit from removal of nonnative fish. He supported this project as being beneficial to native fish and amphibians compared to the current state with rainbow trout × Yellowstone cutthroat trout × westslope cutthroat trout hybrids. The amphibians present in the project area coevolved with westslope cutthroat trout. Nonnative trout may exert different predation pressure on stream-dwelling species and riparian specie (Benjamin et al. 2011; Lepori et al. 2012). Establishment of a coevolved assemblage of fish, invertebrates, and amphibians mimics the biological integrity of streams throughout western Montana.

<u>Zooplankton</u>
Rotenone has greater initial effects on abundance and diversity of zooplankton in lakes than on stream-dwelling invertebrates given the longer period of exposure and their permeable bodies (Vinson et al. 2010). Biomass of zooplankton recovers rapidly; however, zooplankton community composition can take from 1 week to 3 years to return to pretreatment conditions (Beal and Anderson 1993; Vinson et al. 2010). Like stream-dwelling invertebrates, zooplankton have life history strategies that aid in rapid recolonization following disturbance (Havel and Shurin 2004). Recovery of zooplankton varies among taxa, with a dramatic bloom of early colonizers in the first few months (Beal and Anderson 1993). Other taxa take longer to recover, but the diversity and abundance can return as quickly as 6 months. The number and diversity of zooplankton increased in Devine Lake in the Bob Marshall Wilderness in Montana following a rotenone treatment (Rumsey et al. 1996). Densities of zooplankton in upper and lower Martin lakes nearly Olney, Montana were like or greater than pre-rotenone treatment two years after treatment (Schnee 1996). Although rotenone is toxic to zooplankton, field studies confirm the effects are short-term and minor, with populations rebounding first in biomass, then in diversity. The decay of fish carcasses in the treated lakes provides nutrients that fuel the zooplankton rebound.

Zooplankton have multiple ways to recolonize standing waters (Havel and Shurin 2004). Many species of zooplankton are capable of asexual reproduction, which favors rapid recolonization from existing eggs and zooplankton that survived treatment. Moreover, lakes have a long-term bank of dormant eggs. Wind, animals, and humans disperse dormant eggs from neighboring lakes. Zooplankton communities would likely follow the typical cycle of rapid recolonization of early colonizing species. The zooplankton community would recover in a few months to a few years. The rapid recovery of numbers would reset the food web and provide fertile waters for the return of fish.

Research in Norway demonstrated rapid recovery of zooplankton using CFT Legumine concentrations and duration of exposure in lakes. Zooplankton were sampled before application of CFT Legumine, immediately after treatment, and 1-year posttreatment (Amekleiv et al. 2015). CFT Legumine had an initial negative effect on zooplankton, with none detected immediately after treatment. The relative abundance of zooplankton changed from pretreatment to 1-year post treatment, with some species comprising a much higher proportion of the zooplankton community posttreatment. In addition, overall abundance of zooplankton increased considerably posttreatment. Removal of common roach (*Rutilus rutilus*), a species of minnow that preys on zooplankton, was attributed to greater posttreatment zooplankton biomass.

Consistent with FWP's piscicide policy, baseline data on zooplankton communities were collected in September 2015 (Pierce et al. 2018) to allow for monitoring the response and recovery of zooplankton to rotenone treatment. The communities had relatively low diversity with less than 10 species observed in either lake. Most zooplankton would die from exposure to rotenone, but populations would recover through the multiple means of recovery and recolonization (Havel and Shurin 2004). Zooplankton populations would be sampled a minimum of 1 year after piscicide treatment to evaluate the longer-term response.

<u>Stream-Dwelling Aquatic Invertebrates</u>
Rotenone can result in temporary reduction of gilled aquatic invertebrates in streams, but they are resilient and recover rapidly. Invertebrates that are most sensitive to rotenone also tend to have short life-cycles, which results in the highest rates of recolonization (Cook and Moore 1969; Engstrom-Heg et al. 1978). Although gill-respiring invertebrates are a sensitive group, many are far less sensitive to rotenone than fish (Schnick 1974; Chandler and Marking 1982; Finlayson et al. 2010). Due to their short life cycles (Wallace and Anderson 1996), strong recolonization ability (Williams and Hynes 1976), and generally high reproductive potential (Wallace and Anderson 1996), aquatic invertebrates are capable of rapid recovery from disturbance (Boulton et al. 1992; Matthaei et al. 1996).

Fisheries managers are using CFT Legumine across continents in native fish conservation projects, and they use similar protocols, which allows for generalizations among studies. Practices to limit mortality of nontarget organisms include using the lowest effective concentration to kill fish and limiting the duration of exposure. Consistently, studies of aquatic invertebrates in streams treated with CFT Legumine under current practice show the populations recover within a year (Skorupski 2011; Kjærstad et al. 2015; Bellingan et al. 2019). Mortality of aquatic invertebrates associated with rotenone application as proposed for this project is slight to moderate (Skorupski 2011), leaving a substantial proportion of invertebrates unharmed. These survivors reproduce and contribute to recovery of the community.

Treatment with rotenone mimics environmental stressors under which aquatic invertebrates evolved. Streams are prone to periodic disturbance such as floods, wildfire, and extreme drought, and these events can kill or displace invertebrates from reaches of stream. Aquatic invertebrates are adapted to periodic disturbance and have several mechanisms to recolonize depopulated reaches. Combined, these mechanisms result of rapid recovery of aquatic invertebrates affected by rotenone treatment or reduced by natural disturbance.

Aquatic invertebrates have a strong tendency to drift (Townsend and Hildrew 1976; Williams and Hynes 1976; Brittain and Eikeland 1988), which is transport of invertebrates by stream flow. Aquatic invertebrates are adapted to running waters, but they can be dislodged, or they may actively drift to avoid predation or find new food patches (Brittain and Eikeland 1988). The importance of drift in dispersal of stream-dwelling invertebrates is an area of extensive study. Moreover, drift is what makes fly fishing with nymphs possible as a sport, as artificial nymphs mimic naturally drifting invertebrates.

Downstream drift of invertebrates is the major mechanism by which aquatic invertebrates recolonize streams and accounted for over 40% of invertebrates recolonizing experimentally depopulated reaches of stream (Williams and

Hynes 1976). Fishless headwater reaches are not treated with rotenone, and these areas have tremendous capacity to contribute high diversity and large numbers of invertebrates (Wipfli and Gregovich 2002; Hollis 2018). The amount of energy contributed from aquatic and terrestrial invertebrates and detritus drifting from 1 kilometer (0.62 miles) of fishless headwaters could support 100-2000 young of the year salmonids (Wipfli and Gregovich 2002). The abundance of aquatic invertebrates drifting from fishless headwater reaches was enough to support 25% of the adult trout in fish-bearing waters (Hollis 2018). The rate of invertebrate drift in mountain streams in Montana was considerable, with 15.6 invertebrates drifting per cubic meter per second flow (Skorupski 2011). Although rate of drift varies with numerous factors (Brittain and Eikeland 1988), treated reaches of stream would receive a substantial, continuous supply of invertebrates from untreated headwaters, which would contribute to rapid recovery of invertebrate populations. The short-term reduction and absence of fish would also contribute to recovery of invertebrate populations providing a productive stream when fish are returned to treated streams.

Reproduction by aerial adults is the secondary mechanism aquatic invertebrates use to recolonize streams. Reproduction by winged adults accounted for 28% of invertebrates recolonizing experimentally depopulated reaches of stream (Williams and Hynes 1976). Having a winged adult state that flies upstream to reproduce or disperses from neighboring areas counteracts the constant passive or active drift of larval invertebrates and allows for repopulating reaches following disturbance.

Movement of invertebrates from deeper in the substrate and from downstream are other mechanisms of recolonization. Upstream movement of aquatic organisms is a relatively minor mechanism for recovery (Williams and Hynes 1976) and would likely not be a large contributor to recovery in streams with a downstream barrier. In contrast, invertebrates moving up from deeper in the streambed has better potential to contribute to recovery. Experimentally, this source contributed about 18% of invertebrates recolonizing a depopulated reach (Williams and Hynes 1976). Eggs, pupae, and larvae deeper in the streambed may be resistant to rotenone or not receive lethal concentrations of rotenone, especially in reaches with substantial groundwater contribution, which would dilute rotenone applied at the surface. Fieldworkers in Montana reported impressive hatches of caddisflies, mayflies and midges in streams and lakes during treatment and the day after treatment with rotenone, indicating recolonization through reproducing adults can begin immediately after treatment.

Because piscicide has potential to alter abundance and species composition of aquatic invertebrates over the short-term, FWP piscicide policy requires pretreatment sampling of benthic aquatic invertebrates (FWP 2017). FWP and the MNHP sampled benthic macroinvertebrates throughout the project area, providing a robust baseline of benthic communities before treatment with rotenone (Pierce et al. 2015). Posttreatment monitoring would allow for evaluation of short-term and long-term trends in community composition and recovery.

Potential Effects on Species of Special Concern and Sensitive, Threatened or Endangered Species
Presence or potential presence of species of concern comes from field sampling and observations and the Montana Natural Heritage Program database. The Montana Natural Heritage Program (MNHP) maintains a database and field guide on species distribution, status, ecology, life history strategies of animals, and sightings throughout the state. This database provided the technical basis for determining potential effects on species of special concern. The database includes a comprehensive list of citations to support information presented in the field guide and this document.

Extensive pre-project aquatic sampling yielded several stonefly nymphs of the genus *Utacapnia* in Sourdough Creek (Pierce et al. 2015). This genus is identifiable to species in the adult phase, which occurs in late winter through early spring. The MNHP lists *Utacapnia columbiana*, common name Columbian snowfly, as a S2 species of special concern in Montana. The USFS does not assign a ranking to this species. Winter stoneflies often have small ranges, as their ability to disperse is limited. Nevertheless, the Columbian stonefly, while usually rare, has a wide range that extends from the Yukon to Montana, Oregon, and California (Dosdall and Giberson 2014).

Utacapnia are small winter stoneflies that emerge in winter or early spring, and recreationalists in forests during winter often observe them walking on snow. The first records of the Columbian stonefly in Montana were from the Kootenai River, and distribution appeared to be restricted to areas of high precipitation where Pacific coastal climate moderated extremes in temperatures (Gaufin et al. 1972). The Columbian stonefly was among the most infrequently reported stoneflies in a survey of stoneflies in Glacier National Park and the Flathead River basin; however, several congeners were relatively abundant (Newell et al. 2008).

Verifying the species of winter stoneflies in the project area would be challenging. Traveling to Sourdough Creek, the stream with *Utacapnia*, during winter would require skiing or snowshoeing into remote wilderness and catching the window in which they emerge, which can occur from March through June (Gaufin et al. 1972). The level of effort for an event with unpredictable timing makes this effort infeasible.

The zoologist with MNHP recommended assuming the larval *Utacapnia* could be the Columbian stonefly. A short segment of Sourdough Creek, the stream where *Utacapnia* were found, supports fish, and over 2 miles of fishless headwaters would not be treated. *Utacapnia*, regardless of species, would likely be resilient to piscicide treatment as drift from the fishless headwaters would be a continuous, diverse, and abundant source of aquatic invertebrates to the treated area (Williams and Hynes 1976; Brittain and Eikeland 1988; Wipfli and Gregovich 2002; Hollis 2018).

Posttreatment monitoring would assess the status of *Utacapnia* in Sourdough Creek; however, interpretation of monitoring results should consider the species rarity (Newell et al. 2008) and the natural variability of species presence in samples (Vinson et al. 2010). Rare species may be absent from samples but still present in streams. Although winter stoneflies have reduced dispersal capability compared to other species of aquatic invertebrate, the broad geographic range of the Columbian stonefly (Dosdall and Giberson 2014) indicates they can disperse from other streams.

The project area is within the range of numerous species of special concern and species designated as sensitive by the USFS (Table 4). The ranges delineated are broad and may not reflect the suitability of habitat for a given species occurring within the project area. This evaluation focuses on species likely to live and breed in a high elevation, forested, montane environment during the treatment period in August, and includes observations of species, evidence of breeding, or other indicators of a species' presence.

The species of special concern with the most potential to experience exposure to rotenone in the area are dragonflies (subarctic darner and brush-tipped emeralds), western toads, great blue herons, harlequin ducks, northern bog lemmings, and grizzly bears. Potential impacts to these species are discussed in the following paragraphs. Other species of concern are terrestrial and do not rely on streams for food. Terrestrial species would have potential to experience short-term and minor disturbance associated with presence of fieldworkers. They would also have short-term exposure to rotenone-treated water, but concentrations would be well below levels that would cause harm.

The presence of dragonfly species of concern is conjectural based on proximity of existing collections to the project area. If present, the dragonfly species of special concern would experience short-term and minor adverse effects, if any, from the proposed action. These species prefer open bogs, fens, marshes, and meadows. Dragonflies appear to be unaffected by rotenone at concentrations applied in fish removal projects. Dragonflies are gill-respiring as nymphs or naiads. They respire with gills that are growths in the walls of their hind guts. Despite being gill-respiring taxa, bioassays with the dragonfly *Macromia* sp. found this genus to be exceptionally tolerant of rotenone, and among the most tolerant of the 15 taxa tested (Chandler and Marking). The average concentration that was lethal to 50% of test organisms (LC_{50}) for 96 hours was 25 ppb. Field application in wetlands would likely be 25 to 50 ppb; however, natural breakdown, binding with soils, and dilution with groundwater or stream inflows is expected to degrade rotenone to concentrations nontoxic to dragonflies well before the 96-hour threshold for the LC_{50} would occur. Moreover, neighboring lakes and wetlands would provide a source of recolonization.

Table 4. Species of special concern, sensitive, and threatened species with ranges overlapping the project area.

Class	Scientific Name	Common Name	State Rank	USFS Status
Snails	*Oreohelix alpina*	Alpine mountainsnail	S1	
	Oreohelix elrodi	Carinate mountainsnail	S1	
Insects	*Aeshna subarctica*	Subarctic darner	S1S2	
	Somatochlora walshii	Brush-tipped Emerald	S1S2	
Bony fish	*Salvelinus confluentus*	Bull trout	S2	Threatened
	Oncorhynchus clarkii lewisi	Westslope cutthroat trout	S2	Sensitive
Amphibians	*Anaxyrus boreas*	Western toad	S2	Sensitive
Birds	*Ardea herodias*	Great blue heron	S3	
	Histrionicus histrionicus	Harlequin duck	S2B	Sensitive
	Accipiter gentilis	Northern goshawk	S3	
	Aquila chrysaetos	Golden eagle	S3	
	Picoides arcticus	Black-backed Woodpecker	S3	Sensitive
	Dryocopus pileatus	Pileated woodpecker	S3	
	Nucifraga columbiana	Clark's nutcracker	S3	
	Certhia americana	Brown creeper	S3	
	Troglodytes pacificus	Pacific wren	S3	
	Catharus fuscescens	Veery	S3B	
	Ixoreus naevius	Varied thrush	S3B	
	Leucosticte tephrocotis	Gray-crowned Rosy-Finch	S2B	
	Haemorhous cassinii	Cassin's finch	S3	
	Coccothraustes vespertinus	Evening grosbeak	S3	
Mammals	*Sorex hoyi*	Pygmy shrew	S3	
	Myotis lucifugus	Little brown myotis	S3	
	Lasiurus cinereus	Hoary bat	S3	
	Synaptomys borealis	Northern bog lemming	S2	Sensitive
	Ursus arctos	Grizzly bear	S2	Threatened
	Pekania pennanti	Fisher	S3	Sensitive
	Gulo gulo	Wolverine	S3	Sensitive
	Lynx canadensis	Canada lynx	S3	Threatened

S1 = At high risk because of extremely limited and/or rapidly declining population numbers, range and/or habitat, making it highly vulnerable to global extinction or extirpation in the state.
S2 = At risk because of very limited and/or potentially declining population numbers, range and/or habitat, making it vulnerable to global extinction or extirpation in the state.
S3 = Potentially at risk because of limited and/or declining numbers, range and/or habitat, even though it may be abundant in some areas.
S2B = an at risk breeding population, with an S2 ranking
Sensitive = Listed as a sensitive species USFS regions 1 and 2.
Threatened = Listed as threatened under the U.S. Endangered Species Act

Western toads breed in slow areas in streams and likely breed in lakes and wetlands in the project area. Adults have thick, impermeable skin and tend to occupy terrestrial areas. Depending on treatment time, some vulnerable tadpoles may be in the treatment area and succumb to rotenone. Adults would not be affected and would reproduce the next spring. The western toad's impressive reproductive potential would offset any mortality of tadpoles. Females can produce an extraordinary number of eggs, with a record clutch size of 20,000 eggs observed in Montana (Maxell et al. 2003).

Great blue herons live year-round in Montana, and the proposed action could have short-term and minor effects on this species. Short-term reduction or eradication of fish would affect their forage base; however, birds are highly mobile, and can move to non-treated waters. Moreover, although fish comprise a sizeable proportion of their diet, great blue herons are generalists, and consume invertebrates, reptiles, amphibians, mammals, and birds. Voles are among species eaten by great blue herons and would be unaffected by piscicide treatment.

The MNHP database has records of harlequin ducks breeding in the project area. Harlequin ducks have the strategy of living primarily along coastal, rocky shores of the Pacific Ocean; however, they fly hundreds of miles inland to breed in high gradient, mountain streams. Males arrive first in early spring and depart in June after mating. Females arrive later and remain until late July to early September. Few, if any, harlequin ducks would be present as ducklings would have fledged, and fledglings and hens would have returned to their coastal habitat by September. The potential disturbance to harlequin ducks remaining in the project area would be presence of fieldworkers, which would be minor and short-term. The low concentration of rotenone, and the short duration of its occurrence in streams would not present a threat to harlequin ducks.

The proposed action would result in minor and short-term disturbance to the bat species of concern in the project area. Hoary bats primarily eat invertebrates of terrestrial origin, so effects on their forage base would likely be negligible. Little brown myotis eat a greater diversity of invertebrates including mosquitoes and crane flies, both of which are of aquatic origin. Nevertheless, they are generalists in the invertebrates they eat and piscicide treatment would not affect the gnats, wasps, and moths that compose a substantial proportion of their diet.

Grizzly bears are present in the project area, and the project would increase the potential for conflicts with humans by producing dead fish within the North Fork Blackfoot River and its tributaries. Furthermore, fieldworkers would be venturing into grizzly bear habitat, which could result in potentially dangerous encounters with grizzly bears. Project timing may reduce the risk of grizzly bear encounters as they typically feed at high elevation during early fall.

To prevent bear-human conflicts, all attractants, including food, garbage, and chemicals associated with fish removal, would be stored in compliance with the relevant food storage order for the Lolo or Helena-Lewis and Clark National Forest. Because of the current low abundance of hybrid trout in the project area, fish killed through chemical treatment would not be collected as transporting and storing dead fish would potentially attract bears. The presence of dead fish would be short-term, as scavengers and decomposition would quickly eliminate the carcasses. In lakes, most carcasses would likely sink (Bradbury 1986), especially with cold water temperatures expected at this elevation in late summer through early fall (Parker 1970). Wind and waves have potential to drive fish that do not sink towards shorelines. Accumulations of wind-driven fish carcasses would be removed from the shoreline and sunk in the lake.

To mitigate for risks of conflicts between bears and humans, fieldworkers will typically work in pairs when possible, make noise, and stage out of backcountry cabins or outfitter base camps. All participants in project activities would be trained in bear safety practices and the proper use of bear spray and would always carry bear spray while working in the backcountry. Signs would educate the public on the project and warn recreationists about the potential for increased bear activity along the stream or lakeshores. To minimize disturbance to grizzly bears, helicopter use would be limited to 4-6 days during treatment. Daily helicopter flight paths would avoid high elevations where grizzly bears feed in the fall and follow stream corridors. Any incident involving a grizzly bear or black bear would be reported to the USFS representative within 24 hours. Project activities may be immediately temporarily suspended or modified if such an action is necessary in order to prevent bear-human conflicts. Adherence to these procedures would result in minor, short-term impacts to grizzly bears.

The project area is within critical habitat for Canada lynx. Streams are present in narrow corridors in the forested areas occupied by Canada lynx, which would result in little overlap with project fieldworkers making encounters with fieldworkers short-term and minor. They consume mostly snowshoe hare but will switch to grouse when hare populations are low. They do not eat fish and any exposure to rotenone killed fish would be incidental, short-term and would not pose a health risk. Canada lynx may drink treated water; however, the concentration of rotenone in treated water is well below thresholds that would present a health risk. Moreover, the duration to exposure to rotenone-treated water or dead fish would be short-term.

Northern bog lemmings live in a variety of habitat types, including wet meadows, fens, and bogs. Northern bog lemmings consume moss, sedges, grass, and some invertebrates. Potential disturbance to northern bog lemmings would relate to presence of fieldworkers dispensing rotenone in fens, bogs, and wetlands with potential to support fish, and a potential, short-term loss of invertebrate prey, although vegetation, the main component of their diet, would not be affected. These disturbances would be short-term and minor, as humans would be present for only several days treating wetlands, and terrestrial and rotenone-tolerant aquatic invertebrates would still be available.

Creation of a Barrier to the Movement or Migration of Animals
This project would not create a barrier to movement or migration of animals. A natural waterfall at the downstream extent of the project would protect the established populations of westslope cutthroat trout from invasion of nonnative fishes.

Increase in Conditions That Would Stress Wildlife
The temporary placement and occupancy of spike camps for treatment crews and the presence of fieldworkers walking in and along streams and attending drip stations would be the only stressor on wildlife. These stressors are unlikely to persist for more than 3 – 4 days per stream. The necessary equipment and supply distribution could be accomplished with about 10 flights in and out of wilderness over 2 days, and 5 flights to remove gear after the project has been completed These stressors are short-term and minor.

3.4.2 Alternative 2: No Action

This alternative would leave rainbow trout hybrids in the headwaters of the North Fork Blackfoot River, which is the highest priority stream for conservation of native fish in the Blackfoot River watershed (Pierce et al. 2002). Hybridization and climate change are primary threats to westslope cutthroat trout. State and federal agencies, the Blackfoot Challenge, the Big Blackfoot Chapter of Trout Unlimited, and many cooperating landowners have a long history of conservation to benefit native fish. The nonnative fish upstream of the North Fork Falls remains as a perpetual source of rainbow trout and Yellowstone cutthroat trout genes that threaten native westslope cutthroat trout in the watershed below.

The rainbow trout hybrids would continue to exert a different predation pressure on aquatic organisms than would the native westslope cutthroat trout, which would extend to riparian species. Nonnative fish are functionally different predators resulting in altered predation pressure on aquatic organisms (Lepori et al. 2012). The presence of fish that have not coevolved with the assemblage of aquatic invertebrates alters ecological dynamics with riparian invertebrates (Benjamin et al. 2011).

Nonnative fish have likely altered the character of the aquatic and riparian ecosystems regardless of whether westslope cutthroat trout had been present before fish introductions or if the project area had been fishless. Given the high dispersal ability of most aquatic invertebrates, no species likely to be present have not coevolved with westslope cutthroat trout. Greatly suppressing the nonnatives and stocking westslope cutthroat trout would establish a coevolved community of organisms that has been eliminated from most of the westslope cutthroat trout’s historical range.

3.4.3 Cumulative Effects on Wildlife and Fish

The proposed action would establish a secure population of westslope cutthroat trout in an area that is expected to retain suitable habitat for westslope cutthroat trout in a warming climate (Isaak et al. 2017) and would eliminate a source of nonnative genes that threaten nonhybridized westslope cutthroat trout in the watershed below. Some aquatic invertebrates and some gilled amphibians would die; however, aquatic organisms evolved in disturbance prone environments and have multiple means to recover, as has been documented in numerous studies. Rotenone would not harm other species of wildlife. The presence of fieldworkers would result in short-term disturbance to wildlife. Timing the project for early-August into September would limit conflicts with grizzly bears, which are feeding at high elevations at this time.

The no action alternative would be detrimental to westslope cutthroat trout in the North Fork Blackfoot River watershed downstream of the project area. The existing hybridized fishery with predominantly rainbow trout genes would continue to exert predation pressure on invertebrates that is alien to the ecosystem.

3.5 *Water Resources*

3.5.1 Alternative 1: Proposed Action

Changes in Water Quality from Use of Piscicide

The proposed project would intentionally introduce a liquid formulation of rotenone to surface water to remove nonnative rainbow trout hybrids. A pilot study in 2018 evaluated the duration rotenone remained toxic in streams in the North Fork Blackfoot River and estimated the lowest effective concentration that would achieve a fish kill while minimizing effects on nontarget organisms (Clancey et al. 2018). Typical concentrations in Rocky Mountain streams are 25 to 50 ppb of rotenone; however, some waters in the North Fork Blackfoot River are rich in organic matter, which binds to rotenone rendering it ineffective. The pilot study found up to 97% of rotenone was broken down or absorbed within 4-hour of stream travel time. The abundance of debris jams slowed water flow considerably and exposed treated water to organic matter that bound with the rotenone.

In light of the results of the pilot study (Clancey et al. 2018), the proposed concentration of rotenone would be higher than the 25 to 50 ppb that is usually effective. The minimum formulation concentration needed to effectively remove nonnative trout in some streams would be at least 2 ppm CFT Legumine, which is 100 ppb of rotenone. In areas with high organic load, up to 4 ppm of CFT Legumine may be necessary. These concentrations are within the label-allowed limits.

The liquid rotenone formulation would be applied by drip stations (Figure 6) or IV bags (Figure 7) in a controlled manner to achieve the desired instream concentration using streamflow data from the previous day. Fieldworkers with backpack sprayers would spray off-channel waters with potential to hold fish. Rotenone mixed with sand, water and gelatin may be placed at seeps to maintain toxic concentrations of rotenone during the treatment period.

Several factors influence rotenone's persistence and toxicity. Warmer water promotes deactivation of rotenone, which has a half-life of 14 hours at 24 °C and 84 hours at 0 °C (Gilderhus et al. 1986; Gilderhus et al. 1988), meaning that half of the rotenone is deactivated and no longer toxic at that time. As temperature and sunlight increase, so does the rate of deactivation of rotenone. Bright sunlight in June deactivated 15 ppb rotenone in 10 cm of water to nontoxic concentrations in 2-3 hours (Brown 2010). Higher alkalinity (>170 mg/L) and pH (>9.0) also increases the rate of deactivation. Rotenone tends to bind to and react with organic molecules, and availability of organic matter substantially decreases the persistence of rotenone (Dawson et al. 1991). Dilution from groundwater upwelling or inflows from untreated tributary streams also contributes to the deactivation of rotenone.

FWP's piscicide policy (FWP 2017) requires deactivation of rotenone using potassium permanganate, a strong oxidizer. Potassium permanganate would minimize exposure beyond the treatment area. Pretreatment monitoring would determine if contributions of groundwater increase flows to the point that additional potassium permanganate would be needed. Potassium permanganate deactivates rotenone within 15 to 30 minutes of mixing time with stream water. This reach of stream is the neutralization or deactivation zone. Full deactivation of rotenone requires delivery of potassium permanganate at a rate that maintains a residual concentration of potassium permanganate of 0.5-1.0 ppm after 30 minutes stream travel time. At this point, neither rotenone nor potassium permanganate would be present at toxic concentrations, and any residual would continue to degrade into nontoxic constituents.

The deactivation station would be set up immediately downstream of the confluence of the North Fork Blackfoot River and the East Fork North Fork Blackfoot River. Deactivation of potassium permanganate would prevent toxic concentrations of rotenone from reaching the North Fork Blackfoot River downstream of the waterfall, which supports bull trout. Based on previous dye tests, this deactivation site will likely allow 30 minutes of contact before flows reach the barrier falls; however, the pretreatment dye testing will evaluate this assumption, and the station may need to be moved accordingly to achieve the required 30 minute mixing zone upstream of the waterfall.

CFT Legumine and Prenfish, the two liquid rotenone formulations that could be used during this project, are 5% rotenone, and the remaining constituents are inert ingredients used to dissolve and disperse the relatively insoluble rotenone. The inert ingredients in CFT Legumine do not include the organic solvents used in other formulations. The inert solvents and dispersant have the advantage of having low to no toxicity at the concentrations applied, and they break down rapidly in the environment (Fisher 2007). Many constituents are used in products like toothpaste, sunscreen, and eye drops (Fisher 2007). The low concentrations, general lack of toxicity, and rapid breakdown of the inert ingredients in water does not pose a risk to health or violate water quality standards.

The inert ingredients in Prenfish include organic solvents and dispersants. These compounds are volatile and break down rapidly in the environment. Application of potassium permanganate would further break down the organic chemicals in Prenfish. Dilution, natural breakdown, and deactivation with potassium permanganate would result in the organic chemicals in the Prenfish formulation having a short-term and minor effect on water quality.

Monitoring the effectiveness of potassium permanganate in deactivating rotenone would occur at a site 30 minutes streamflow time downstream from the potassium permanganate application site. Maintenance of the target concentration of potassium permanganate of 0.5–1.0 ppm would be determined with a handheld chlorine meter. Caged fish placed at the site would provide additional evidence of whether potassium permanganate was successful in deactivating rotenone. Survival of caged fish at the 30 minute site indicates the potassium permanganate has successfully degraded the rotenone to nontoxic concentrations. Application of potassium permanganate would continue until caged fish placed immediately upstream of the deactivation zone survive for 4 hours without distress, indicating the natural breakdown of rotenone upstream of the deactivation zone.

Dead fish would be present during and after this project. A relatively small proportion of dead fish would be noticeable, as sinking, rapid decomposition, and scavenging by wildlife would contribute to disappearance of killed fish. In lakes, most fish would likely sink. About 70% of fish in treated lakes in Washington did not surface (Bradbury 1986). Cooler water temperatures and greater depths inhibit surfacing of dead fish. In warm water ponds supporting members of the sunfish family, nearly all fish surfaced, except when temperatures were < 58 °F, when most fish sank and decomposed, and cool temperature and depth were attributable for the sinking of dead fish (Parker 1970).

The elevation and timing of treatment would result in temperatures favorable to the sinking of dead fish. Therefore, a relatively small proportion of dead fish would be visible, and those fish would decompose and be eaten by scavengers. Nevertheless, fish that do not sink tend to be swept by wind and waves to shorelines. These fish may be gathered and sunk in the lake.

Decaying fish in rotenone-treated lakes can result in temporary nutrient enrichment and algal blooms. In Washington, 9 of 11 lakes treated with rotenone had an algal bloom shortly after treatment, and an estimated 70%

of the phosphorus contributed from dead fish remained in the lake with decomposition of fish (Bradbury 1986). Nutrient loading from dead fish may temporarily contribute to aesthetically unappealing algal blooms; however, keeping the nutrients within the lake is beneficial in replenishing the food web. High elevation lakes tend to be nutrient-poor, so nutrients contributed from their decay stimulates phytoplankton production, which promotes rapid recovery of zooplankton and other invertebrates in treated lakes. Rotenone kills zooplankton, but biomass of zooplankton recovers rapidly following rotenone treatment (Beal and Anderson 1993; Vinson et al. 2010). Algae take up the nutrients released by decaying fish, and zooplankton and other aquatic invertebrates feed on the algae. This rapid recovery of algae and invertebrates provide abundant food for when fish are returned to the lake.

Potential Effects on Groundwater Quality

No contamination of groundwater is anticipated from this project. Rotenone-treated water could go subsurface in losing stream reaches and lakes; however, rotenone binds to the streambed sediments, soil, and gravel, and does not persist in groundwater (Engstrom-Heg 1971; Engstrom-Heg et al. 1978; Skaar 2001; Ware 2002). Rotenone moves only 1 inch in most soil types, except sandy soils, where it moves about 3 inches before binding to soils (Hisata 2002). In California, studies of wells in aquifers near to and downstream of rotenone application have never detected rotenone, rotenolone, or any of the organic compounds in formulated products (CDFG 1994). CFT Legumine does not contain the organic compounds used in other formulations of rotenone. The inert solvents and dispersants in CFT Legumine would not contaminate groundwater given their low toxicity and rapid breakdown.

Case studies in Montana have concluded that rotenone does not move measurably in groundwater (FWP unpublished data). At Tetrault Lake, neither rotenone nor inert ingredients were detected in a nearby domestic well, which was sampled 2 and 4 weeks after the lake was treated, despite being downgradient and within the same aquifer as the lake. FWP has sampled wells and groundwater in several piscicide projects that removed fish from ponds, and no rotenone or inert ingredients were detected in ponds ranging from 65 to 200 feet from treated waters. Likewise, rotenone applied to streams has not resulted in contamination of neighboring wells or groundwater. No rotenone was found in domestic wells adjacent to Soda Butte Creek and drawing from the same aquifer.

The proposed project area is in designated wilderness and far from domestic wells. No rotenone would be present in a domestic water supply.

Effects on Other Water Users

Irrigation, stock water, and recreation are the potential water uses for most rotenone projects. As the project is in designated wilderness, and rotenone would not reach irrigated lands, the project would not affect irrigators. Likewise, as detailed in the assessment on effects on wildlife and fish, rotenone-treated water would not pose a health risk to horses and mules drinking from streams. Stock owned by the outfitters contracted to assist with the project would not be allowed to drink from any surface water on the day of it being treated.

Relevance to State of Federal Water Quality Standards

Montana DEQ issues a pesticide general permit on a five-year cycle to FWP that allow FWP to apply piscicides. FWP, and other piscicide applicators, must develop a pesticide discharge management plan as a condition for coverage under the permit. For FWP, the plan consists of procedures and protocols described in FWP's piscicide policy (FWP 2017), the American Fisheries Society's standing operating procedures for rotenone application (Finlayson et al. 2018), annual training, and critical review of projects by FWP's piscicide committee.

The project area is within the Scapegoat Wilderness, so a piscicide use permit from the USFS is required. This project would proceed with issuance of a piscicide use permit from the USFS.

3.5.2 Alternative 2: No Action

Under the no action alternative, no changes relating to state or federal water quality standards would occur, and no permits would be necessary.

3.5.3 Cumulative Effects on Water Resources

Implementing the proposed action would result in release of rotenone into fish-bearing waters in the North Fork Blackfoot River, upstream of a barrier waterfall. Stream and lake water would be toxic to fish, some invertebrates, and gilled amphibians for a few hours each day of stream treatments and up to a few weeks in lakes. As rotenone is a highly reactive molecule, it would break down quickly through natural processes, and would be accelerated by mixing with potassium permanganate upstream of the barrier falls. The inert ingredients have low toxicity and brief period of persistence. As the project area is miles upstream of irrigated agriculture, this use would not be affected. Rotenone would not reach domestic wells. Livestock drinking treated water would not be exposed to rotenone. This work would be performed under the general pesticide permit issued by DEQ. As the project is in designated wilderness, a pesticide use permit would be required from the USFS. The no action alternative would not affect water resources.

4 EFFECTS ON THE HUMAN ENVIRONMENT

4.1 *Aesthetics and Recreational Opportunities*

4.1.1 Alternative 1: Proposed Action

Fishing would be the primary recreational opportunity affected by this alternative. The proposed action would result in a temporary yet drastic reduction of fish in the project area. Absence of catchable fish in streams and lakes would last for 1 month to 1 year until replanting of westslope cutthroat trout repopulated waters. Population levels would remain low in streams for several years until natural reproduction augmented numbers of fish planted.

Rainbow trout would remain widespread in Montana and provide high quality recreational angling. With establishment of westslope cutthroat trout, this project would provide the opportunity to fish for native species in a spectacular and remote setting and allow anglers the opportunity to experience the biological heritage of Montana present before widespread introduction of nonnative trout and the impacts of climate change.

The presence of dead fish would temporarily affect aesthetics. These fish would not be removed but remain as a source of nutrients to promote recovery of the food web. Owing to bacterial growth and scavenging, dead fish would disappear within a few days, resulting in minor and short-term decrease in the aesthetics of the area.

Recreation would be affected by temporary closure of streams and lakes in the project area. Public access to waters in the project area would be closed while rotenone is being applied to the waters. Trails may be closed temporarily to isolate the stream treatment area, but these closures will be minimized to the shortest duration possible.

4.1.2 Alternative 2: No Action

The no action alternative would allow persistence the existing populations of rainbow × Yellowstone cutthroat × westslope cutthroat trout hybrids. It would not provide anglers with opportunities to fish for native westslope cutthroat trout.

4.1.3 Cumulative Effects on Aesthetics and Recreational Opportunities

Implementing the proposed alternative would result in almost 70 stream miles and over 40 acres of lake that provide secure, connected habitat for westslope cutthroat trout. Native trout draw anglers from around the world, and locally, to catch these beautiful fish. The quality of the angling would be reduced over the short-term; however, westslope cutthroat trout are better adapted to the cold waters in the project area and would likely provide superior fishing opportunities than those that currently exist. Although the primary goal of the project is native fish conservation, improved angling would be a secondary benefit.

4.2 *Community and Taxes*

4.2.1 Alternative 1: Proposed Action

The proposed action may have an initial, short-term negative effect on the local community due to the temporary reduction of the fishery and fishing, although establishment of native species would mitigate for this loss. Moreover, establishment of a population of westslope cutthroat trout in the project area would provide angling opportunities like those that existed before widespread introduction of nonnative trout. Anglers targeting native fish could choose to visit the Scapegoat Wilderness, which would provide revenue for communities, outfitters and guides.

4.2.2 Alternative 2: No Action

The no action alternative would not have short-term effects on the community; however, over the long term, the cumulative effects of failing to follow through on native fish restoration projects increases the likelihood of including westslope cutthroat trout for protection under the Endangered Species Act. Listing could have a far-reaching effect in communities throughout the westslope cutthroat trout's native range, as it would reduce flexibility in the land and water management activities of landowners, agencies, agriculture, and extractive industries.

4.2.3 Cumulative Effects on Community and Taxes

The project area supports generally low trout abundance; therefore, the proposed alternative would have little, if any, negative effect on the local communities. High quality fishing opportunities would be available in the North Fork Blackfoot River downstream of the falls, and throughout neighboring drainages and the Blackfoot River. Restoring the nonhybridized westslope cutthroat trout would increase the biological integrity and provide an opportunity educate the public about native fish. The local communities could benefit from establishment of a native fishery, with tourists drawn to fish for native species in the spectacular, remote setting.

4.3 *Air Quality*

4.3.1 Alternative 1: Proposed Action

A portable generator would be used at the detoxification station to power the volumetric feeder used to deliver potassium permanganate. This would result in a short-term and minor release of exhaust into the air. Backpack sprayers used in wetlands and backwaters would release a mist of liquid rotenone formulation, but rotenone is not volatile, and would quickly fall out of suspension. Applicators would wear respirators to prevent inhalation of the dilute liquid rotenone solution mist.

Formulations of piscicide proposed for this project are Prenfish and CFT Legumine. These formulations differ in the chemicals used as solvents and dispersants. Prenfish liquid formulated rotenone contains aromatic solvents that make it soluble in water. The smell of these solvents, primarily naphthalene, may last for several hours to several days, especially in lakes, depending on air and water temperatures and wind direction. These relatively heavy organic compounds tend to sink, remain close to the ground, and move downwind. The California Department of Pesticide Regulation found no health effects from this smell (CDPR 1998). Applicators would have the greatest contact with these chemicals but would be protected because they would be wearing respirators as the product label recommends. Any objectionable odors would be short term and minor. CFT Legumine does not contain the same level of aromatic petroleum solvents (toluene, xylene, benzene and naphthalene) of other rotenone formulations and consequently does not have the same odor concerns. Worker handling CFT Legumine would wear masks to limit inhalation of vaporized product.

4.3.2 Alternative 2: No Action

This alternative would not affect air quality.

4.3.3 Cumulative Effects

The proposed activity would have minor, short-term effects on air quality with localized release of exhaust and diluted rotenone formulation mist. The no action alternative would not affect air quality.

4.4 *Noise and Electrical Effects*

4.4.1 Alternative 1: Proposed Action

This alternative would likely use a helicopter to transport gear to remote parts of the project area over the course of several days with several trips occurring per day. A portable generator would also be used at the detoxification station to power the feeder used to deliver potassium permanganate. The detoxification would last several days, which would be short-term and minor, and the noise of the generator would not carry far beyond the stream. The noise and disturbance from helicopter flights would be mitigated by choosing efficient flight paths and using larger helicopters to reduce the number of flights. The proposed action would not have effects on any electrical systems.

4.4.2 Alternative 2: No Action

This alternative would not affect noise or electrical services.

4.4.3 Cumulative Effects on Noise and Electrical Effects

The proposed action would create noise with the use of a helicopter to transport project materials and personal gear to outfitter camps and basecamps as described in the piscicide implementation plan (Appendix A). In the year of treatment, helicopters would be needed for up to 7 days, with up to 20 flights in a single day. This includes the stocking of trout in the first year, which would require trout up to 30 flights and would occur over a maximum of three days In each of the two outyear stocking events, up to 7 flights will be conducted over a maximum of two days each year. The noise would be short-term and minor. The no action alternative would not create noise or affect any electrical systems.

4.5 *Risk or Health Hazards*

4.5.1 Alternative 1: Proposed Action

This project would result in release of a liquid formulation of rotenone into waters in the project area, and release of potassium permanganate downstream of the confluence of the North Fork Blackfoot River with the East Fork North Fork Blackfoot River. Oxidation with potassium permanganate would render rotenone nontoxic within 30 minutes of stream travel time. This point will occur upstream of the falls, and the detox station will be located accordingly to ensure a minimum 30-minute travel time to the falls. Analysis of risks to human health from exposure to liquid rotenone follows information provided by the EPA (EPA 2007) and a study of the toxicity and persistence of the active and inert ingredients in CFT Legumine (Fisher 2007).

Toxicity evaluations examine acute and chronic toxicity. Acute toxicity is the adverse effect of a highly toxic substance from a single exposure or multiple exposures in a short space of time that result in substantial health risks. Rotenone ranks as having high acute toxicity through oral and inhalation routes of exposure, and low acute toxicity through exposure to skin (EPA 2007).

Several factors would be protective of the health of workers handling CFT Legumine or Prenfish and prevent harmful exposure to rotenone. The low concentration of rotenone in CFT Legumine and Prenfish is one factor. It comprises 5% of the formulation, or 5 g/L. No one would be handling pure rotenone. Furthermore, the label for liquid rotenone requires applicators to wear a dust/mist respirator, splash safety goggles, impervious gloves, and coveralls. The personal protective equipment would prevent inhalation, ingestion, and dermal exposure. Goggles would protect eyes from contact with liquid rotenone. Likewise, applicators at the deactivation station would wear personal protective equipment to limit exposure to potassium permanganate.

Applicators would supply containers of liquid rotenone to fieldworkers responsible for operating a given drip station or backpack sprayer. Flow measurements taken the day before would determine the amount of liquid rotenone in the containers required to achieve the target concentrations of rotenone in streams, usually 25 to 50 ppb. Liquid rotenone would be mixed with stream water in drip station cubes or backpack sprayers or dripped directly from the IV bags into the stream. Operators handling liquid rotenone would also wear eye protection, a protective mask, and gloves to prevent exposure to the diluted liquid rotenone. In either case, applicators handling undiluted liquid rotenone and operators applying diluted liquid rotenone to surface waters would not be exposed to rotenone at levels that would be acutely toxic, as personal protective equipment would prevent exposure, and accidental exposure would be to low concentrations of rotenone.

Chronic exposure is repeated exposure from ingestion, inhalation, or dermal contact with the target chemical (EPA 2007). Chronic exposure, as defined in toxicity analyses for humans, is about 10% of the life span. Application of piscicide in North Fork Blackfoot River would likely last less than 30 days. Applicators handling undiluted product have potential for brief contact with rotenone for considerably less than 10% of their life span; however, under label requirements they are required to wear personal protective equipment. Protective eyewear, coveralls, gloves, and dust and mist respirators provide ample protection against any contact with rotenone. Likewise, operators dispensing diluted liquid rotenone at drip stations or with backpack sprayers and undiluted liquid rotenone from IV bags would wear personal protective equipment to prevent exposure.

Exposure to rotenone by eating dead fish is highly unlikely, and streams and lakes would be closed to the public during treatment. Signs posted at trailheads and access areas would inform the public of the presence of dead fish and alert people to not eat dead fish. Microbes work quickly on dead fish, so decay is obvious within a few hours, and these fish would not be appealing to humans looking for a meal. Signs warning the public and rapid onset of decomposition of dead fish would result in extremely low probability that humans would eat rotenone killed fish.

Although consumption of rotenone contaminated fish is unlikely, in the rare chance someone ate rotenone-killed fish or fish that left the project area without receiving a lethal dose, this exposure would not result in a health risk. The EPA evaluated the potential dose of rotenone from eating dead fish. In each step of their analysis, they factored safety into their equations to develop a risk analysis that would be highly protective of human health (EPA 2007). The EPA chose safety levels for females 13-49 years old, as a potentially sensitive group (EPA 2007). In determining potential exposure from consuming fish, the EPA used maximum residues in fish tissues killed by rotenone. This concentration is a conservative estimate of potential exposure, as it includes rotenone accumulated in tissues other than muscle tissue, such as kidneys and liver, which would not be palatable to humans, but may have higher concentrations of rotenone than muscle. The EPA concluded that acute dietary exposure from the unlikely occurrence of eating rotenone-killed fish resulted in a dietary risk below their level of concern. Therefore, people eating rotenone-killed fish, despite posted warnings, would not face a health risk.

The EPA developed toxicological endpoints for several types of exposure to rotenone in treated waters and included uncertainty factors to ensure endpoints would be conservative and most protective of human health (EPA 2007). Rotenone projects would result in exposures far below the no observable effects level for acute dietary exposure, chronic dietary exposure, incidental short-term exposure from consumption of rotenone-killed fish, and short, intermediate, and long-term dermal exposure. Personal protective equipment worn by workers would reduce potential for exposure within this margin of safety. Closing public access to the streams and lakes are extra precautionary actions designed to provide added assurance that human health would not be at risk from rotenone projects.

The EPA concluded risks from chronic exposure to rotenone-treated water in streams conveyed low risk to humans (EPA 2007). Rotenone's rapid breakdown in the environment and deactivation with potassium permanganate would limit the duration rotenone is present in treated waters. The label prohibits use of rotenone near waters diverted for domestic use, and this remote watershed does not provide water for domestic uses.

The requirement that the public be notified of rotenone in treated waters would also protect human health for the short duration it is present in streams and lakes. Notifying the public through local papers, public meetings, and placing signs at trailheads and access points would alert the public to the presence of rotenone in treated water.

The temporary closure of waters to recreational uses is an added safety measure to protect human health. Application concentrations of less than 90 ppb of rotenone does not pose a threat to humans engaged in recreational activities after it is applied to water and has been mixed (EPA 2007). By comparison, concentrations of rotenone typical of fish removal projects in similar areas involving trout is generally around 25 to 50 ppb, although they can be adjusted higher within label limits if the usual range is not effective. When the application level is lower than 90 ppb, signs may be removed, and the closure lifted immediately after the application is complete. For stream treatments exceeding the 90 ppb level, signs can be removed following a 24-hour bioassay demonstrating survival of fish, analytical chemistry showing less than 90 ppb rotenone, or 72 hours, whichever is less. For standing water treatments over 90 ppb, signs must remain posted for up to 14 days unless fish do not die during a 24-hour bioassay or rotenone is measured to be less than 90 ppb in the water.

The inert ingredients in CFT Legumine do not pose a threat to human health (Fisher 2007). Inert ingredients are primarily solvents and dispersants needed to dissolve and disperse the relatively insoluble rotenone. The emulsifier Fennedefo[99]™ comprises the bulk of the inert ingredients in CFT Legumine. This inert additive is a formulation of fatty acids, resin acids, and polyethylene glycols, which are common constituents in soaps, and other consumer products such as soft drinks, toothpaste, eye drops and sun tan lotions. Its concentration in treated waters would be many orders of magnitude lower than concentrations that are toxic, and it breaks down rapidly in the environment. Other trace constituents were organic compounds used in the extraction of rotenone from the raw plant parent material and were at minute concentrations and would be undetectable in streams or lakes and far below toxic concentrations. In contrast, Prenfish and other formulations of rotenone use organic solvents to dissolve and disperse rotenone, and CFT Legumine does not contain these chemicals except in trace amounts. The low toxicity and concentration of inert ingredients, combined with the rapid breakdown in the environment, would not pose a threat to human health or the environment.

The solvent n-methylpyrrolidone comprised 10% of CFT Legumine. The safety data sheet for n-methylpyrrolidone provided toxicity information that confirms Fisher's assertion that this chemical would not be toxic as applied in piscicide projects (Fisher 2007). Mice exposed to 1,000 ppm/day for 3 months showed no adverse effects. The combination of its exceptionally low concentration in treated water and its rapid breakdown in the environment mean n-methylpyrrolidone would not present a threat to human health or the environment.

Prenfish also consists of petroleum emulsifiers. Finlayson et al. (2000) wrote regarding the health risks of these constituent elements:

> . . . the EPA has concluded that the use of rotenone for fish control does not present a risk of unreasonable adverse effects to humans and the environment. The California Environmental Protection Agency found that adverse impacts from properly conducted, legal uses of liquid rotenone formulations in prescribed fish management projects were nonexistent or within acceptable levels (memorandum from J. Wells, California Department of Pesticide Regulation, to Finlayson, 3 August 1993). Liquid rotenone contains the carcinogen trichloroethylene (TCE). However, the TCE concentration in water immediately following treatment (less than 0.005 mg TCE per liter of water [5 ppb]) is within the level permissible in drinking water (0.005 mg TCE per liter of water, EPA 1980b). None of the other materials including xylenes, naphthalene, piperonyl butoxide, and methylnaphthalenes exceed any water quality criteria guidelines (based on lifetime exposure) set by the EPA (1980a, 1981a, 1993). Many of these materials in the liquid rotenone formulations (trichloroethylene, naphthalene, and xylene) are the same as those found in fuel oil and are present in waters everywhere because of the frequent use of outboard motors . . .

California Department of Fish and Game (CDFG 1994) calculated that the maximum expected level of these contaminants following a treatment level of 2 ppm formulation are TCE 1.1 ppb; toluene 84 ppb; xylenes 3.4 ppb; naphthalene 140 ppb.

The occupational risks to humans is low if proper safety equipment and handling procedures are followed as directed by the product labels (EPA 2007). The major risks to human health from rotenone come from accidental exposure during handling and application. This is the only time when humans are exposed to concentrations that are greater than that needed to remove fish. To prevent accidental exposure to liquid formulated or powdered rotenone, the Montana Department of Agriculture requires applicators to be:

- Trained and certified to apply the pesticide in use
- Equipped with the proper safety gear, which, in this case, includes respirator, eye protection, rubberized gloves, hazardous material suit
- Have product labels with them during use
- Contain materials only in approved containers that are properly labeled
- Adhere to the product label requirements for storage, handling, and application

Personnel handling Prenfish have risk for dermal and inhalation exposure. To guard against this, ground applicators would be equipped with protective clothing, goggles, and respirators.

Concern over a potential link between rotenone and Parkinson's disease occasionally emerges with piscicide projects. Research into the links between rotenone and Parkinson's disease include laboratory studies intended to induce Parkinson's-like symptoms in laboratory animals as a tool for neuroscientists to understand the mechanism of Parkinson's disease (Betarbet et al. 2001; Johnson and Bobrovskaya 2014), epidemiological studies of Parkinson's disease in farmworkers (Kamel et al. 2007; Tanner et al. 2011) and laboratory studies evaluating risks associated with inhalation of rotenone powder (Rojo et al. 2007).

The studies aimed at creating Parkinson's like lesions as a tool for neuroscientists to study the disease (Betarbet et al. 2001; Johnson and Bobrovskaya 2014) do not provide a relevant model for field exposure during piscicide treatments. These studies entailed continuous injection of high concentrations of rotenone into the bloodstream for long durations with a chemical carrier to facilitate absorption into tissues. Such studies differ substantially from piscicide projects in terms of dose, duration, and mode of delivery and are not relevant to this project.

Epidemiological studies have proposed a link between pesticide use in general and Parkinson's disease; however, definitive evidence of a causal link between rotenone exposure and Parkinson's disease has not been found, as results of epidemiological studies have been highly variable (Hubble et al. 1993; C L Lai et al. 2002; Guenther et al. 2011; Tanner et al. 2011). A widely cited study reported a positive correlation between agricultural use of rotenone with Parkinson's disease (Tanner et al. 2011); however, review of methodologies and assumptions in these studies demonstrates the difficulties in using epidemiological data in hazard identification (Raffaele et al. 2011). These after-the-fact studies cannot assess variability in rotenone formulations, dose, frequency of exposure, and whether workers used personal protective equipment. Moreover, exposure to other pesticides is a complicating factor, as farm workers usually have exposure to multiple pesticides. Epidemiological studies do not allow evaluation of the extent to which other factors such as age and genetics contribute to development of the disease.

Application of rotenone in fish management projects is dissimilar to past application in agriculture, so these studies are not relevant to fish removal projects when conducted according to label requirements. Rotenone-applied pesticide in agriculture and on pets and livestock was in powder form, which would have considerable potential to become airborne. In contrast, the rotenone in CFT Legumine is in liquid form, so no particles would be transported by air currents. The concentration of rotenone required to achieve a fish kill is minute, whereas the rate of application in agriculture is unknown. Finally, personnel handling rotenone wear protective equipment that prevents or minimizes exposure through inhalation, ingestion, and contact with skin with use of personal protection equipment and does not resemble exposure likely experienced by farmworkers, who may have not been wearing protective equipment and had greater potential for exposure to multiple pesticides.

4.5.2 Alternative 2: No Action

This alternative would have no effect on human health or related hazards.

4.5.3 Cumulative Effects on Human Health

The proposed action would pose minimal risk to human health if applicators use prescribed protective gear while applying liquid rotenone. The protective measures exceed those recommended by the EPA (EPA 2007). The low concentration of rotenone used in piscicide projects and its brief duration in the environment would not pose a threat to human health from contact with treated water. Likewise, although signs would alert the public to not eat killed fish, the concentration of rotenone in fish tissues would not pose a risk to human health. The no action alternative would have no effects on human health.

4.6 *Cultural Resources*

4.6.1 Alternative 1: Proposed Action

This alternative would not affect cultural resources because no ground ground-disturbing activities are part of the proposed action.

4.6.2 Alternative 2: No Action

This alternative would not affect cultural resources.

4.6.3 Cumulative Effects on Cultural Resources

Neither alternative would affect cultural resources.

5 NEED FOR AN ENVIRONMENTAL IMPACT STATEMENT

Evaluation of the environmental, social, cultural, and economic effects of the proposed alternative found any effects to be short-term and minor. Moreover, the proposed action would be beneficial in achieving conservation goals for westslope cutthroat trout. The community would benefit from protecting and improving the status of these species of special concern and important sport fish.

Evaluation of the no action alternative found this alternative would have no negative effects on most aspects of human health or the environment. However, this alternative would not contribute to conservation of westslope cutthroat trout, a species of special concern. Rainbow trout × Yellowstone cutthroat trout × westslope cutthroat trout hybrids continue to spill into waters supporting nonhybridized westslope cutthroat trout, which jeopardizes this population. Protecting genetically unaltered westslope cutthroat trout is the highest priority under the MOU for cutthroat trout conservation in Montana (MCTSC 2007). State and federal law authorizes agencies and their partners to implement projects that increase the distribution of westslope cutthroat trout in their historical ranges, and the North Fork Blackfoot River project area provides an ideal location to achieve huge conservation benefit.

Finally, FWP reviewed the alternatives and found the proposed alternative would have no, or only short-term and minor effects on all the categories evaluated. Therefore, there is no need for the preparation of an environmental impact statement.

6 PUBLIC PARTICIPATION

6.1 *Public Involvement*

The public will be notified in the following manners about the opportunity to comment on this current project, its Draft EA, the proposed action, and alternative:

- Legal notices will be published once each in each of these newspapers: *Blackfoot Valley Dispatch* (Lincoln), *Independent Record* (Helena), *Missoulian*, and *Seeley Swan Pathfinder*.
- Public notice will be posted on FWP's webpage: http://fwp.mt.gov ("News," then "Public Notices"). The Draft EA would also be available on this webpage, along with the opportunity to submit comments online.
- A news release would be prepared and distributed to a standard list of media outlets interested in FWP issues. This news release would also be posted on FWP's website http://fwp.mt.gov ("News").
- Direct mailing or email notification would be made to adjacent landowners and other interested parties (individuals, groups, agencies) to ensure their knowledge of the proposed project.
- Copies would be available at the FWP Region 2 Headquarters in Missoula and the FWP State Headquarters in Helena.
- Copies of this draft EA may be obtained by mail from Region 2 FWP, 3201 Spurgin Rd., Missoula 59804; by phoning 406-542-5540; by emailing shrose@mt.gov; or by viewing FWP's Internet website http://fwp.mt.gov ("Public Notices").

Public Meeting: FWP will hold a public meeting on July 22, 2020 beginning at 6:30 pm, to present the proposal, answer questions, and take public comment. Due to the Governor's orders regarding distancing and gathering of groups during the Covid pandemic, this meeting will be a "virtual meeting," conducted using a video conferencing platform.

Virtual meeting information. A livestream of the public meeting will be available for the public to watch on FWP's website, http://fwp.mt.gov, on the webpage where the North Fork Blackfoot DEA is posted.

Commenting during the virtual meeting. There will be an opportunity to provide public comments by dialing in by phone during the public comment portion of the meeting:
Dial +1 646 558 8656
Webinar ID: 981 3965 8750
Password: 673265
To "raise your hand" when you are ready to comment, press *9, and you will be unmuted and able to comment. At that time, please mute the livestream of the meeting on your device to minimize background noise. Please state your name and where you are from before making a comment.

This level of public notice and participation is appropriate for a project of this scope with no significant physical or human impacts and only minor impacts that can be mitigated.

6.2 *Public Comment Period*

The public comment period will extend for thirty (30) days beginning July 9, 2020. Comments must be received by FWP no later than August 7, 2020.

Comments may be made online on the EA's webpage (see 2nd bullet in section 6.1 above), emailed to Sharon Rose at shrose@mt.gov, or mailed to the FWP address below:

Region 2 FWP
Attn: Sharon
3201 Spurgin Rd
Missoula, MT 59804

6.3 *Parties Responsible for Preparation of the EA*

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APPENDICES

A. Piscicide Implementation Plan

B. Minimum Requirements Decision Guide (MRDG) Workbook

*Please note that the **Appendices** total over 100 pages and might not be included in this printed copy of the Draft EA. You can find the Appendices on FWP's website—please see the EA's webpage information in the 2nd bullet under section 6.1 (Public Involvement) above. Or contact Sharon Rose at FWP (see 6th bullet under section 6.1).*